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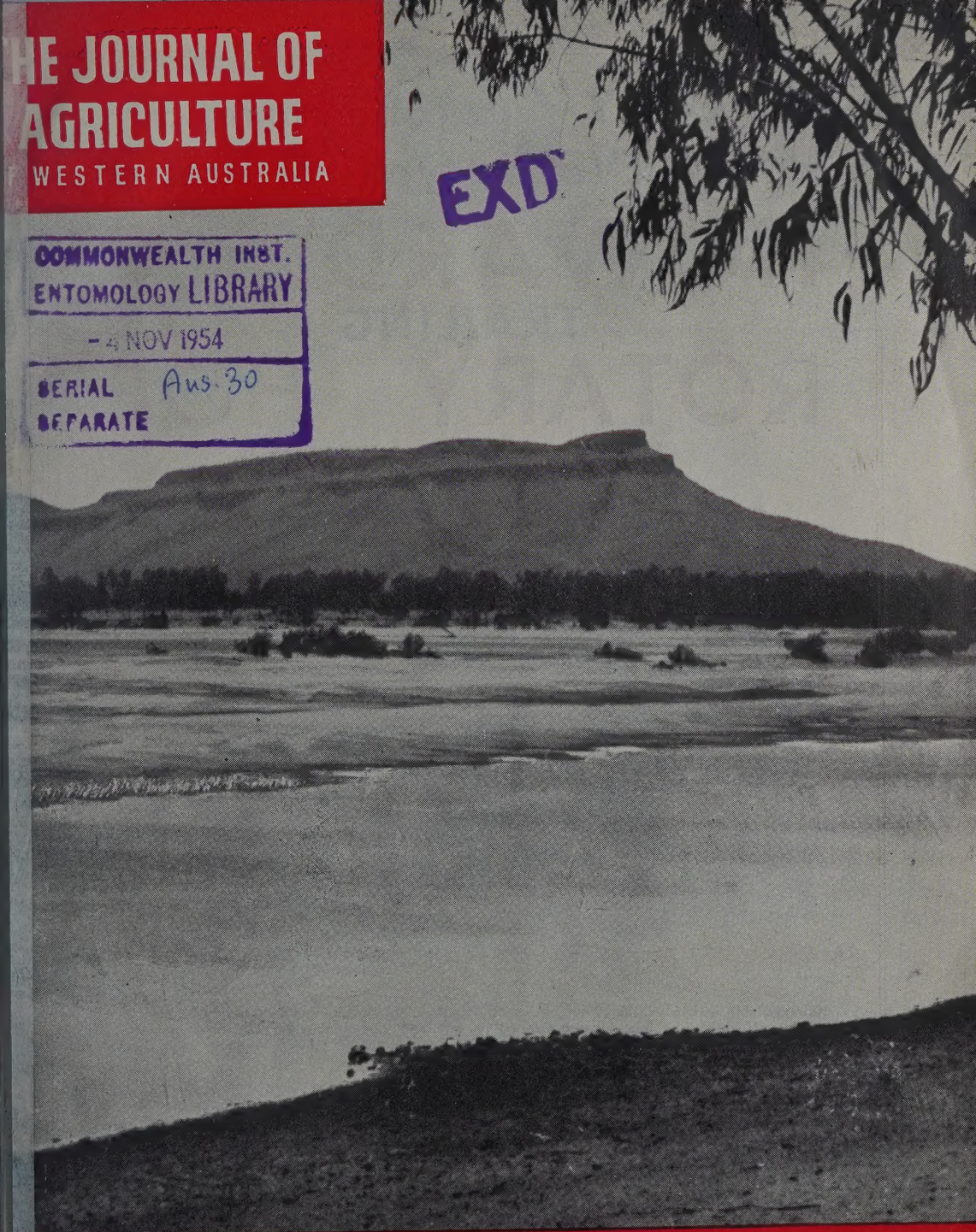

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WESTERN AUSTRALIA

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**COVER PICTURE**

A mighty torrent during the wet season, the Ord River, East Kimberley, was only a series of placid pools in September when this photograph was taken. House Roof Hill, a well-known landmark, towers in the background and a large flock of cockatoos line the water's edge at the left of the picture.

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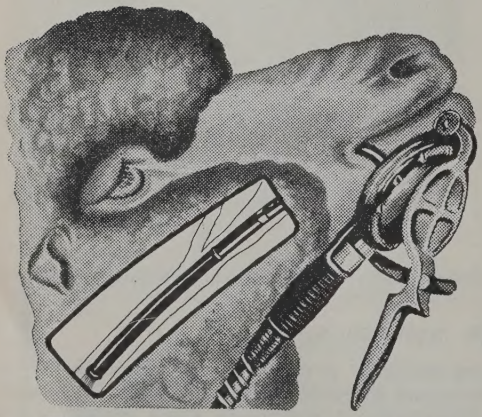

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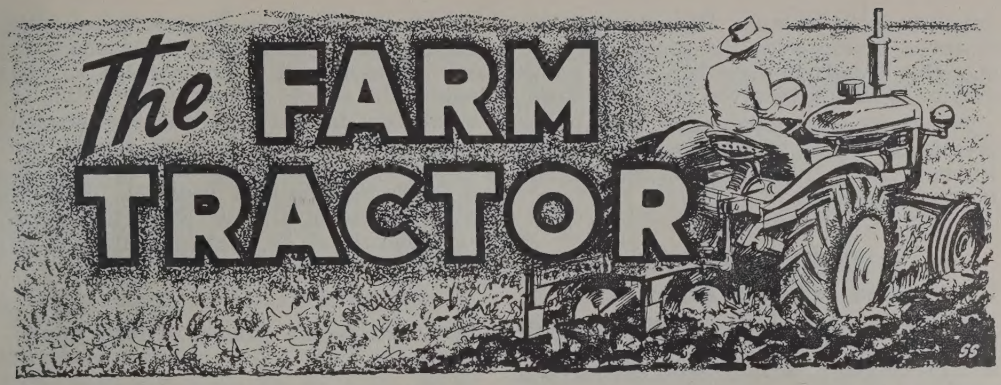


## Part 3.—Tractor Maintenance

**FULL instructions for the maintenance of the tractor are given in the makers' handbook and these will differ in detail between various makes. The general principles are the same, however, and are set out here.**

### DAILY ROUTINE

**1. Cooling System.**

Inspect the radiator and see that it is full of water. Always use soft water, i.e. rain water, since hard water deposits scale and renders the cooling system less efficient. In any case the water must be clean and free from mud and sediment. In winter an anti-freeze mixture is sometimes used. This contains a liquid, e.g. glycerine, which has a lower freezing point than water, and so remains liquid during a frost.

If a tractor is to be left out at night in cold weather, and NO anti-freeze mixture is used, then the water must be drained out of the radiator and cylinder block overnight and replaced next morning. When empty a "No water" notice should be hung on the radiator cap to avoid the risk of starting up before refilling. Water expands when it freezes and the expansion is sufficiently powerful to crack the cylinder block and damage the radiator if water is allowed to freeze in the cooling system. With some tractors it is necessary to drain the block and radiator separately. There are then two drain cocks, both of which must be opened. In the case of an engine fitted with a thermostat it is advisable when possible to use anti-freeze compound, and not to drain it, because sometimes when starting up with the air temperature well below freezing point, the cold air sucked through by the fan will freeze the water in the radiator before the thermostat opens and starts the warm water circulating.

**2. Crankcase Oil.**

With the tractor on level ground and the engine stopped, pull out the dipstick, wipe it clean, replace it for a second, then take it out and read the oil level. It should be at the mark F on the dipstick. If it is below the mark, "top up" with clean engine oil.

**3. Greasing.**

Go over all the grease nipples with a grease gun. This should be done methodically, starting at a definite place, such as the steering column, and going round the tractor greasing all points in the order in which you come to them. If the operator goes from point to point in no particular order some are sure to be missed.

When greasing round, remember that even if the bearings are not short of grease the grease already there will contain grit accumulated during the previous day's work. A mixture of grease and grit forms a grinding compound which causes excessive wear on bearing surfaces. The grease gun therefore should be used until clean grease oozes out of the joints; this ensures that the old grease in the bearings is changed for new which is free from grit. At some grease points such as on the thrust race of a dry clutch the actual part being

greased cannot be seen. In such cases two or three strokes with the grease gun are enough. Finally if there is a water pump greaser it should be given one turn down.

Tracklaying tractors have even more grease points than wheeled tractors. These will be found in the instruction book for the tractor concerned.

## WEEKLY ROUTINE

**1. Gear Box and Final Drives.**

Check the oil level in the gearbox, and in the final drive case where this is separate, and if necessary "top up" with appropriate gear oil.

**2. Air Cleaner.**

Examine the oil in the air cleaner and, if it is dirty or there is any sediment, drain it out, clear away the sediment and refill with fresh oil.

The engine oil drained from the sump is in most cases quite satisfactory if put into the air cleaner. Very often bad starting is due to the oil in the air cleaner being too thick to allow air to be drawn through it easily; used engine oil is a relatively thin oil and prevents this trouble.

**3. Water Pump.**

Remove the water pump greaser cap and refill it with special hard W.P. grease. The soft grease which is used in the grease gun must not be used for the water pump, as it melts at the working temperature of the engine and is lost in the water.

**4. Sediment Bowl.**

Remove the sediment bowl and empty the fuel, water and dirt collected in it; clean the gauze filter if necessary. The sediment bowl on some models is fitted with a square-headed drain plug at its base; remove this and after the bowl has been drained turn on the tap and flush out with vapourising oil.

**5. Engine Oil.**

In vapourising oil tractors this should be drained and replaced by new oil every 50-60 working hours, or after a full week's work. Diesel engines and petrol engines do not need such frequent draining. Drain the oil at the end of the day or at a meal-time, when it is warm and will flow out readily.

Clean the screen in the crankcase with petrol before replacing the drain plug. In some cases an oil filter is fitted to the engine; this should be cleaned according to the makers' instructions whenever the oil is changed. On no account should the crankcase be washed out with vapourising oil before refilling with clean oil. Used oil should be saved and stored in clean dry tins when it can be used for a number of purposes including:

1. Filling the tractor air cleaner.
2. Lubricating a number of farm implements.
3. Painting on plough mouldboards and other bright parts of farm machinery to prevent rusting.
4. As a wood preservative.
5. As an insecticide for poultry houses.
6. As a weed-killer.

**6. Tyres.**

Check the tyre pressures: rear tyres should be at 10-12 lbs. and front tyres at 24 lbs. pressure.

**7. Cleaning Down.**

It pays at this time to clean the mud off the tractor and generally freshen up the machine: the transmission housing and engine should be wiped over with an oil rag to clear off oil which may have spread over the machine and picked up dust. At the same time notice whether there are any loose bolts—e.g. the wheel-holding bolts or spud bolts may be slack—or whether there are leakages of fuel or oil. Early attention to small points like these will save serious breakdowns and add to the serviceable life of the tractor.

## OTHER POINTS REQUIRING ATTENTION

**1. Transmission and Final Drives.**

These should be drained once every season and refilled with the appropriate grade of gear oil.

**2. Magneto.**

Put a few drops of light oil on the bearings now and again. Occasional examination of the contact-breaker gap should be

made. When fully open this gap ought to be about 0.020 of an inch. Feeler gauges can be purchased for testing this.

**3. Radiator.**

Once every six months drain and flush the radiator. If the pores have become blocked with chaff or dust this can be removed by hosing the back of the radiator, and so washing out the obstructions.

**4. Spark Plugs.**

About once a month the spark plugs should be removed and cleaned if necessary, and the gaps adjusted to about 0.030 of an inch.

The operator should keep a log book in which he can note down the amount of fuel and oil which he uses, the number of hours worked, the implements used, and the dates on which each routine service has been given. In this way it is easy to be sure when the tractor needs draining and refilling with fresh oil and so on. Otherwise these attentions tend to be forgotten and the tractor runs with old oil longer than it should.

The figures give a check on the fuel which the tractor uses and soon show when it is beginning to get out of adjustment and use more fuel than it ought.

## TROUBLE HUNTING

While it is not advisable for the operator to attempt to repair a serious breakdown, the tractor sometimes fails to work because some little thing is out of adjustment. The detection of the faults listed here should be within the compass of any competent driver who takes an interest in his machine.

**If the engine fails to start,** any one of the following may be the cause:—

*Fuel System.*

1. Fuel (petrol) tank empty.
2. Fuel turned off.
3. Attempting to start on vapourising oil.
4. Engine overchoked or underchoked.
5. Sediment bowl on fuel line choked, or water in the fuel.
6. Water or dirt in vapouriser or jets.

*Ignition System.*

1. Ignition switched off.
2. Plugs oiled up — plug-points gap wrong.
3. Water on high tension leads or distributor.
4. Water in the magneto.
5. Impulse starter not functioning or out of time.
6. Contact-breaker points stuck open.
7. Short circuit in ignition switch.
8. Magneto failure.

If the engine fails to start see that the petrol and ignition are turned on. Drain some fuel from the carburettor and smell it to make sure it is petrol. If you have been trying to start on vapourising oil, drain the carburettor and run some petrol right through and out of the drain cock. The mixture may be too lean, or too rich. If the engine is overchoked, liquid petrol will have been drawn into the cylinders and the plug points short-circuited. In this case the plugs on removal will be found to be wet. While they are out, swing the engine once or twice to expel some of the rich mixture, wipe and replace the plugs and try again without choking.

If the plugs are not oiled up, make sure that the magneto is giving a spark by detaching a cable from a plug and holding it, by the insulation, about a quarter of an inch from the cylinder head while the engine is being cranked. If there is no spark, check that the contact-breaker points are clean and opening. If they are, then look for water in the magneto.

If the magneto is in order see whether the plugs are sparking properly by laying them, with leads attached, on a shaded part of the cylinder head so that the metal body of the plugs is in contact with the metal of the engine. Watch for the spark as the engine is cranked. If a plug does not spark take it to pieces, clean off the carbon from the electrodes and reassemble. Some plugs cannot be dismantled—these must be cleaned with a wire brush as well as possible. The gap should be about 0.030 ins. or roughly the thickness of a matchbox top. When making this adjustment it is important to bend the earth point and not the centre electrode. If the gap is too wide it will prevent the spark occurring when starting, though the plug may spark satis-

factorily when the engine is hot and running at speed.

If the carburettor is getting petrol and the plugs are sparking, make sure that the jet is not choked.

**If the engine stops suddenly,** it may be due to:—

*Fuel System.*

1. Fuel tank empty.
2. Engine overheated from lack of oil or water.
3. Dirt in the jet or fuel pipe.
4. Water in the fuel.

*Ignition System.*

1. Contact-breaker points stuck open.
2. Magneto shorting.
3. Magneto failure.

If the engine stops suddenly see that there is fuel in the tank. If there is fuel present, see that it is reaching the carburettor. If it is, check the ignition system. Usually if there is an obstruction in the fuel line the engine will begin to falter and then go on again, due to the irregular supply of fuel. This is a warning to clean out the jet and fuel pipes. If the engine has stopped through being overheated the cause should be obvious to the driver, as the tractor will be found excessively hot on inspection, and oil fumes will rise from the crankcase.

If the engine has stopped because of water in the fuel, the only remedy is to drain the tank and carburettor and refill with fresh clean fuel, making sure that the tank is completely drained, because any water in the fuel collects at the bottom of the tank.

**If the engine lacks power and runs irregularly:**

*Fuel System.*

1. Mixture too lean.
2. Mixture too rich.

If the mixture is too rich the engine will show black smoke at the exhaust and fail to pick up speed. If too lean, the engine will run irregularly and tend to backfire. The remedy in either case is to adjust the needle valve or the jet until the engine runs regularly with no exhaust smoke. If it is found impossible to obtain good running by adjusting the needle valve then probably one of the following faults is present:—

1. Choked fuel line, jet or sediment bowl.
2. Air leak in intake manifold.
3. Punctured float.
4. Vapouriser choked with carbon deposit.

If the float is punctured the mixture will be too rich. An air leak in the manifold results in too lean a mixture. If the fuel line is dirty the engine will run regularly without load, but snatch and falter when the load comes on.

Irregular running may also result from any of the following faults:—

*Ignition System.*

1. Dirty plugs.
2. Incorrect plug point gap.
3. Magneto contact-breaker points out of order.
4. Leaking spark plug washer.
5. Advance and retard mechanism out of order.
6. Broken carbon brush in magneto.
7. Oil inside magneto.

If the engine is firing irregularly, set the throttle until it is running at a fair speed, and then, using a screwdriver with a wooden or bakelite handle, "short" each of the plugs in turn by placing the blade of the screwdriver on the cylinder block and touching the plug terminal with the shank. This shorts the plug and stops it from firing. If the plug is working properly a change in the beat of the engine will be heard when the plug is shorted in this way. If no difference is heard in the beat of the engine then that is the offending plug. Take it out, clean it and check the point clearance. If this fails to put the fault right, see that the distributor and contact-breaker are in order. See that the advance and retard lever is working, and whether the magneto brush is worn, or the commutator oily.

## MECHANICAL FAULTS

Mechanical faults are usually outside the scope of the operator. Any unusual noise should be investigated and, if the cause is not immediately obvious, the advice of a skilled mechanic should be obtained.

# POISON Plants OF WESTERN AUSTRALIA

C. A. GARDNER,
*(Government Botanist) and* H. W. BENNETTS, D.V.Sc. *(Principal, Animal Health and Nutrition Laboratories)*

## IRONWOOD

*Erythrophloeum chlorostachys* (F. Muell.)

**THE genus Erythrophloeum comprises five species, native to Africa, China and Northern Australia. At least three of these are known to be poisonous, including E. guineense which was used as an ordeal and arrow poison by the natives of West Africa. The South African species, also, is known to be poisonous to stock.**

The single Australian species *E. chlorostachys* is a tree that is native to the tropical areas. It is common throughout the Kimberleys and as far south as the De Grey River. It occurs in the sandy soils of the open plains or in the quartzite and sandy regions, and may grow to a height of 30 to 40ft.

The tree has widely-spread, leafy branches and the trunk may be 10 to 15ft. tall and 12 to 8in. in diameter with dark grey, or almost black, bark that is fissured or more or less tesselated and rough.

The timber is very hard, close-grained and heavy—hence the common name of "Ironwood"—and is reddish-brown or dark brown in colour.

The tree is sometimes known as "Camel Poison" also as "Black Bean Tree" because the pods remain on the tree long after the seeds have fallen.

The leaves are large and twice divided, the leaflets being roundish and rich green in colour, especially when young, but becoming leathery in age. The flowers are pale yellow, and borne in cylindrical spikes like those of many wattles.

Although species of *Erythrophloeum* have for many years been known to be highly poisonous there seems to be little definite information available regarding the effects produced in the animals poisoned, or of the amounts which must be eaten to cause death.

With regard to *E. chlorostachys* it is stated by Herbert (1921) that all parts of the plant are exceedingly poisonous—the wood, bark, the yellowish sap, leaves, flowers and pods. The leaves are not palatable to stock, generally, but camels eat them readily, with fatal results. In this State, camels only have been reported to be poisoned, but in Queensland and in Northern Territory, large numbers of cattle have died as a result of eating the leaves during periods of drought or when travelling. It has been stated, also, that donkeys, horses and sheep are sometimes poisoned.

The poisonous alkaloid, Erythrophleine, isolated from the African species *E. guineense,* also occurs in the local species *E. chlorostachys.* Erythrophleine has been shown to have an action similar to digitalis, which is used medicinally, particularly as a tonic in chronic heart disease.

Investigations carried out in Central Australia in 1947 and 1948, and reported by Rose (1954), showed conclusively that mortalities in travelling cattle on the Mur-

**IRONWOOD**

*Erythrophloeum chlorostachys* (F. Muell).

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ranji stock route were due to poisoning with *E. chlorostachys.* Feeding tests showed that the leaves were highly toxic to cattle and horses. The leaves were unpalatable, but it was found that amounts of about 2 oz. eaten with the feed or given as a watery infusion of leaves, were sufficient to kill both cattle and horses.

The symptoms and post mortem appearances in the two experimental cattle were identical with those observed in natural cases of poisoning; two experimental horses showed similar signs. The symptoms shown were profuse scouring, depression, and a peculiar sunken appearance of the eyes which seems to be characteristic. In experimental cases death occurred within about 24 hours; cattle poisoned under natural conditions may sometimes recover within a week or two, but only after great loss in bodily condition. On post-mortem examination the only notable features are inflammation of the fourth stomach, and sometimes of the intestines.

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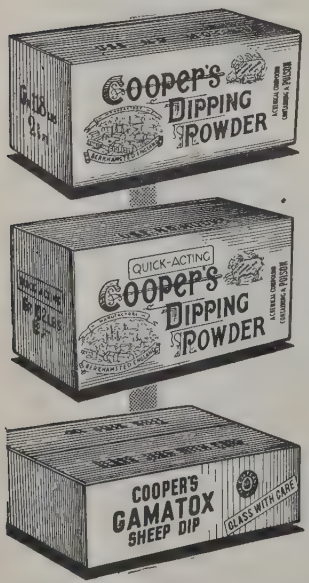


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# CLEARING SCRUB RE-GROWTH

## Novel Use for An Old Circular Saw

Contributed by the Dairy Branch.

**PASTURE land that has been cleared, and then allowed to fall into disuse can present some difficult reclamation problems, especially in the karri country where high rainfall and mild summer weather soon lead to a dense re-growth of suckers and scrub.**

On Mr. J. Wilson's property at Karridale, a discarded 5ft. circular saw blade laid flat, weighted and dragged behind a tractor, was used to good effect in reclaiming old pasture land which carried a heavy re-growth including "swish bush" (*Viminaria demidata*), "prickly mimosa" (*Acacia pulchella*), "sharkstooth" (*Mirbelia dilatata*) as well as a number of suckers from jarrah (*Eucalyptus marginata*) and redgum (*E. calophylla*).

Some of the scrub growth was up to 8ft. in height with stems up to 2in. in diameter while most of the *Eucalyptus* suckers were about 4ft. in height and 1in. in diameter.

Fig. 1.—A disused circular saw weighted with a log and used for clearing scrub regrowth.

Fig. 2.—A photograph showing the encroachment of dense scrub regrowth on clover pasture.

The saw was drilled in two places to take a mild steel bar which was bolted in position well off centre and hitched to the drawbar of a Farmall A tractor.

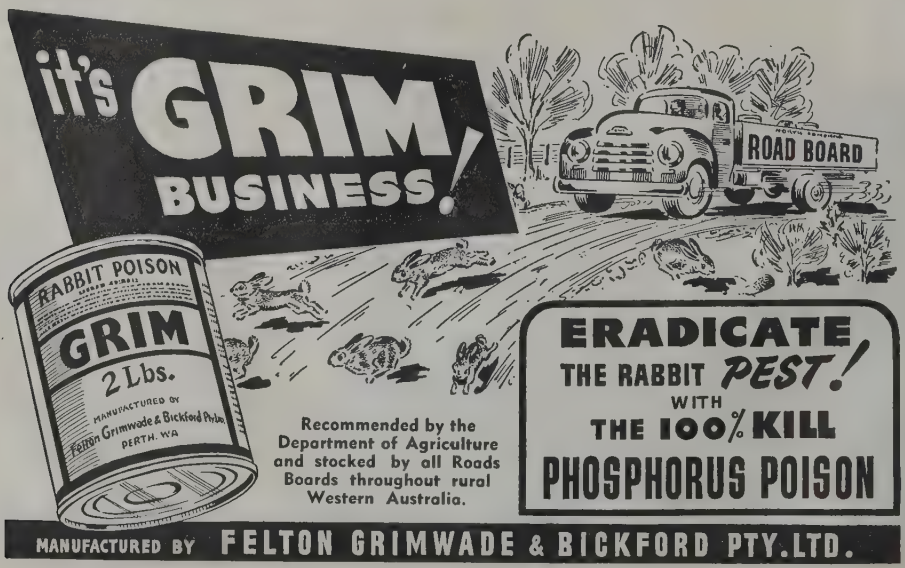
The saw blade was heavily weighted with a log, and later with a slab of concrete. It was found that the teeth of the saw dug into the stems of the scrub causing many of the plants to be uprooted. Those, not uprooted were broken and flattened leaving a dense layer which later dried out and carried an excellent fire.

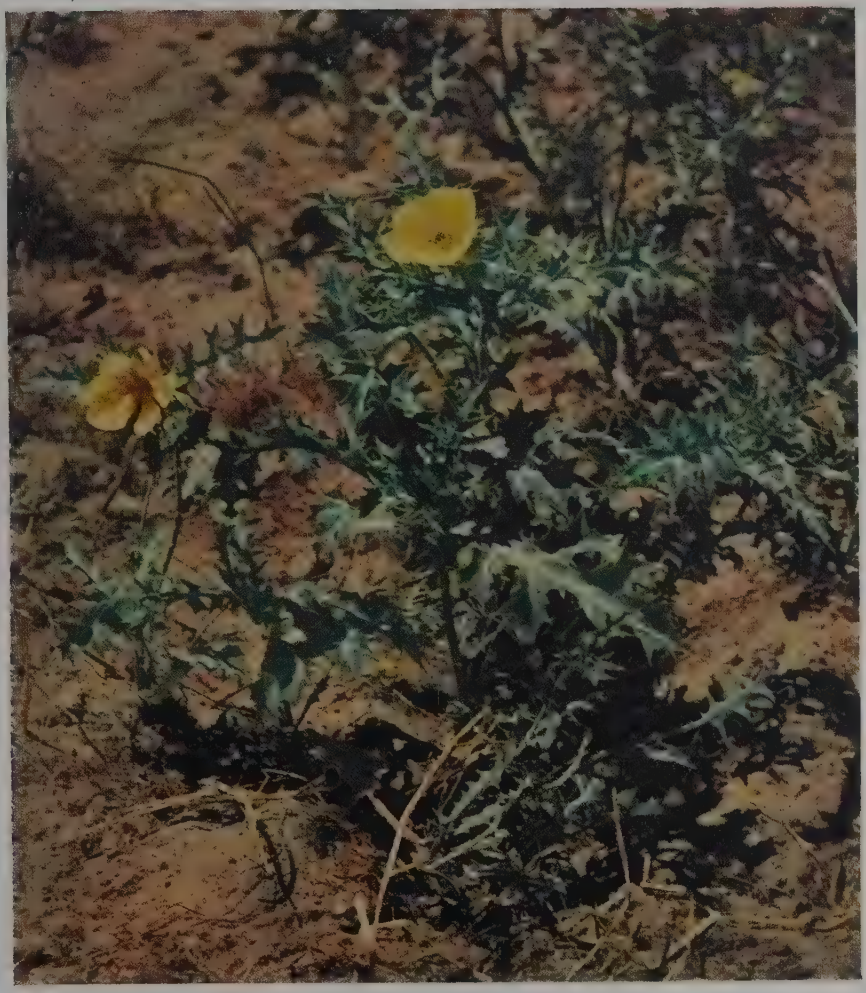
Very little cleaning up was necessary in the wake of the saw, and the land—which was

badly reverted pasture country—is now covered with an excellent growth of subterranean clover, without any re-seeding having been carried out. There is little evidence of further regrowth of scrub.

Labour costs were not excessive as Mr. Wilson reports that, working the tractor in its lower gear range, about one acre an hour could be covered, using approximately a gallon of fuel to the acre.

Fig. 3.—The same pasture after the scrub has been cleared by use of the circular saw dragged behind a tractor.



## MEXICAN POPPY

[*Argemone Mexicana* L.]

Mexican Poppy, as the name implies, is native to Mexico, but also extends to Texas and Central America. In this State it occurs mainly in the Geraldton district although a few plants have been found in widely scattered areas. Besides having toxic properties it can be a troublesome competitor in crops and pastures

# WEEDS of Western Australia

By **G.R.W. MEADLY** M. Sc.
Officer in Charge, Weeds and Seeds Branch

## MEXICAN POPPY

*(Argemone Mexicana L.)*

**AS the name implies, Mexican Poppy is native to Mexico, its range also extending northwards to Texas and southwards to Central America. Although usually referred to as Mexican Poppy, it is also known as prickly or yellow poppy and blue thistle or white thistle. The blue and white are descriptive of the leaf colouration which is shown clearly in the coloured illustration.**

It has been a resident of New South Wales for a long period, the French botanist Verraux having collected specimens in George Street, Sydney, in 1845. One fears that a plant-collecting trip along that thoroughfare at the present time would be both unprofitable and dangerous.

The plant is now widespread in New South Wales and Queensland, especially on soils which retain moisture during the summer months. It has also proved of some consequence in the other Australian States.

Just as the method of introduction to the Eastern States is not known with certainty, its early history in Western Australia is not well defined. It may have become established firstly in the Geraldton district where it now occurs freely on some of the moist flats. Other districts from which it has been recorded include Meekatharra, Menzies, York, Toodyay, Beverley, Tambellup, and Bunbury. Mexican Poppy is known to have been distributed as an impurity in hay and chaff, and this explains in part, at least, its introduction and spread to the areas mentioned.

### DESCRIPTION

As already stated, a portion of the name refers to the country of origin. Argemone being a member of the poppy family, *Papaveraceae,* the remainder of the name is justly applicable. The plants more frequently known as poppies belong to the genus *Papaver* and include several garden species along with the plant from which opium is derived. Although, prior to flowering, it has the appearance of a thistle, Mexican Poppy is not closely related to that group.

It is an annual herb, up to 3 ft. high with sessile, alternate, greyish variegated leaves having acute teeth ending in spines. The flowers are large, solitary, with four pale yellow petals and numerous stamens. The fruit or capsule is oblong, spiny and opening by three to six valves at the summit. It contains a large number of dark-coloured seeds, each having longitudinal rows of tubercles.

### SIGNIFICANCE

Although it can prove a troublesome competitor in crops, most significance is centred around the toxic properties of Mexican Poppy. Experiences are somewhat variable, but there is no doubt that it can prove harmful under some circumstances. Narcotic properties are possessed by a number of members of the family and the presence of a toxic principle in Mexican Poppy is not surprising. Maiden states that some farmers in South Africa consider it to be a useful fodder plant. In New South Wales, although regarded as being unpalatable and seldom eaten by stock, losses have been attributed to it on a number of

**MEXICAN POPPY**

*(Argemone Mexicana L.)*

occasions. In Queensland, White states that the plant is suspected but rarely eaten by stock. He also refers to its reputed toxic properties, but states that it has only proved dangerous "where it has been cut and allowed to wilt and the subsequently softened plants fed to poddy calves. He also makes reference to the intensely bitter sap which renders it unpalatable to animals.

In New South Wales, illness in fowls and a temporary drop in egg production were attributed to the large quantities of Mexican Poppy seeds present among wheat grain on which the birds had been feeding. Subsequently, feeding trials appeared to confirm the assumption. Several birds kept under observation died after varying periods of ingestion.

The toxic principle is not clearly understood, but apparently has decided irritant properties.

Mexican Poppy is a primary noxious weed for the State.

## CONTROL

Being an annual, prevention from seeding must be given first priority when considering control measures. Isolated plants should be pulled or grubbed when they first appear, and those which have seeded before being noticed, should be removed carefully and destroyed, taking care not to scatter the seeds.

With more extensive areas, cultivation is the most practical method, and a year of clean fallow will do much to reduce the extent of this weed. When it occurs in a crop it is advisable to cut for hay before seeds have formed. If it persists in pastures, Mexican Poppy can be controlled by mowing at the early flowering stage in order to prevent seed formation. This procedure is not always entirely satisfactory, however, as the plants sometimes produce lateral flowering shoots following cutting, especially when they are growing on moist land or are favoured by late rains.

Although not highly susceptible to the hormone-like herbicides, when the plants are small they can be controlled by spraying. More mature plants are much more difficult to kill. When growing in a cereal crop one pound of acid equivalent of 2,4-D amine is recommended while under pasture conditions good control can be expected from $1\frac{1}{2}$ pounds acid equivalent of the ester per acre.

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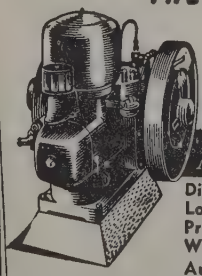

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# COCCIDIOSIS

## A HAZARD OF CHICKEN REARING

By J. E. PETERSON, B. V.sc. Veterinary Pathologist.

**THE devastating effect of an outbreak of coccidiosis in their young chickens is known by experience to many poultry farmers. Fortunately our present knowledge of the disease and the development of new drugs now enable us to prevent or treat outbreaks effectively.**

Fowls of all ages are susceptible to the disease but most outbreaks occur in chickens between the ages of three and eight weeks. On most farms chickens do not come into contact with the disease prior to this age while older birds have been able to develop a resistance to infection.

### THE CAUSE OF COCCIDIOSIS

The name "coccidiosis" is used to cover a group of diseases caused by very closely-related organisms, microscopic in size, known as coccidia.

The several species of coccidia which infect fowls all attack the lining of the intestine, but each species tends to favour a particular area. For example, one species attacks the caeca (the blind sacs near the lower end of the intestine) causing what is known as "caecal coccidiosis", while other species attack different parts of the intestine, in which case the disease is referred to as "intestinal coccidiosis". This is of some importance as it accounts for the different symptoms which may be seen in different outbreaks.

Fig. 1—Typical appearance of chicken suffering from coccidiosis

The life of the coccidia can be conveniently divided into two phases—one spent in the fowl, in the lining of the intestine, and another spent outside the bird, on the ground.

### HOW A CHICKEN BECOMES INFECTED

When a chicken is placed on ground contaminated with coccidia some will be swallowed. When they reach the intestine the coccidia attack and damage its lining. During this period a rapid increase in the number of coccidia occurs. After a period of development in this situation the coccidia are passed out in the droppings where they further increase the contamination of the ground.

### HOW AN OUTBREAK OF COCCIDIOSIS OCCURS

Wherever fowls are kept it can be assumed that there are some coccidia present on the ground. If this contamination remains very light, then the chickens running on the ground will never pick up a sufficient number to cause serious trouble. In fact, by picking up just a few coccidia they will develop a good immunity to the disease.

However, under suitable conditions a few lightly-infected birds can progressively increase the contamination of a pen to a level where an acute outbreak results.

In any poultry run there are places where droppings tend to accumulate, such as around feeding and drinking vessels, under perches or under brooders. When these droppings are heavily loaded with coccidia, birds coming in contact with them will soon pick up a heavy infestation.

The severity of the outbreak will depend largely on the number of coccidia each bird picks up and the period over which the disease is acquired. The general health of the chickens is, of course, also important, as the better this is, the greater will be their resistance to infection.

After an outbreak has subsided the surviving chickens may continue to pass small numbers of coccidia in their droppings for several months and so may heavily contaminate the run for the next lot of birds.

## SYMPTOMS

The symptoms of both caecal and intestinal coccidiosis are rather similar. Affected birds show a loss of appetite, appear depressed and stand with feathers ruffled. The number of birds so affected increases daily and, within a couple of days of the first noticeable sickness, deaths will commence in an acute outbreak.

In **caecal coccidiosis,** blood will appear in the droppings in most cases. This is due to the action of the parasite on the wall of the caeca, causing erosion of the walls of the blood vessels in the area, with consequent haemorrhage. If affected chickens are opened, the caeca, or blind guts, will be found to be distended with blood, which may be clotted, or in less acute cases there may be cheesy plugs with very little free blood. In most cases the site of infection is confined to the caeca, although in very severe cases it may extend a short distance up the intestine.

The picture in **intestinal coccidiosis** varies more than that of caecal infection. The upper two-thirds of the intestine is the usual site affected, and in most cases this portion is rather distended and the intestinal wall thickened. On close examination the gut wall is seen to be studded with small greyish-white or red spots, about the size of a pin-head. The whole affected area may be very inflamed and often the intestine is filled with rather fluid, slimy material which may be greyish in colour or may be mixed with varying quantities of blood. However, many cases do occur, particularly in young chickens, in which the lesions are not very noticable and may even be missed unless looked for carefully. Even when there is a considerable amount of haemorrhage present in the upper intestinal tract it is very seldom that recognisable blood is present in the droppings.

## DIAGNOSIS

Coccidiosis cannot be definitely diagnosed by symptoms alone, but in the majority of outbreaks, particularly if acute, a diagnosis can be made with a reasonable degree of accuracy from a consideration of the symptoms, history of the outbreak and post-mortem findings from the examination of several birds.

Even when such a diagnosis seems fairly certain it is desirable to have it confirmed by laboratory examination. Where there is any doubt it is even more important that a laboratory diagnosis be obtained.

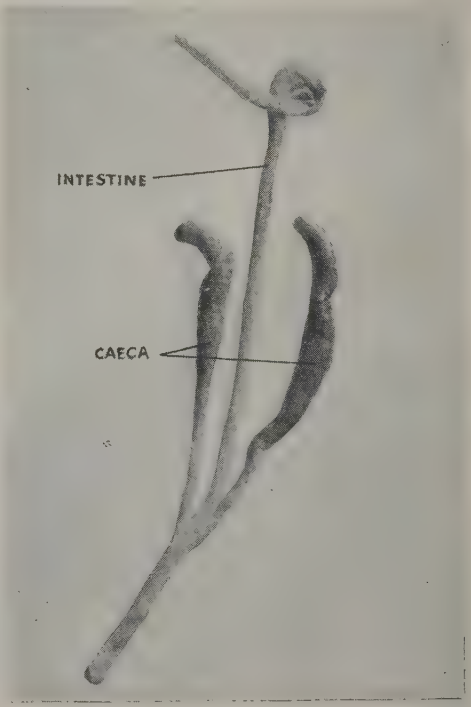


Fig. 2.—Caecal coccidiosis. Both caeca are distended and filled with blood

**When an outbreak is suspected several live, sick, or recently dead chickens should be forwarded to the Department of Agriculture, St. George's Terrace, Perth, or to the Animal Health Laboratory, Smyth Road, Nedlands, as soon as possible, together with a letter giving full particulars of the extent of the outbreak, age of birds affected, symptoms, housing and feeding conditions and any other information considered relevant.**

## PREVENTION

Study of the development of the coccidia and the way in which infection occurs has shown that there are several precautions which can be taken to prevent heavy contamination of brooder houses and runs.

When coccidia are passed out in the droppings they have to pass through certain stages of development, which take about two days, before they can re-infect a chicken. Further, this development only takes place under moist conditions. Thus, if the pens and yards are cleaned every day the risk of heavy re-infection will be eliminated. If, in addition to this, the feeding and drinking vessels are protected from contamination by droppings, the maximum degree of infection occuring should be insufficient to produce symptoms but sufficient to produce immunity.

As the coccidia only reach the infective stage under moist conditions, then, if the compartment floors are kept dry, the amount of infective material present will be greatly reduced. This means that when compartments containing birds are cleaned, the floors should not be moistened. Care should also be taken to see that water from drinking vessels cannot spill or leak on to the floor.

It is possible to keep the birds free of infection by rearing them on raised wire-mesh floors, so that there is absolutley no contact with droppings or with previously contaminated floors. This course is not recommended as a preventive measure as the birds remain fully susceptible and will pick up the diseases as soon as they are taken off the wire.

Brooder runs should not be used for any fowls except chickens. If the runs are grassed this should be kept short for as much of the year as possible as long grass, especially if moist, provides ideal protection for the coccidia which are not particularly resistant to prolonged drying or direct sunlight.

If an outbreak of coccidiosis has occurred it is desirable to disinfect the brooder house and runs before a fresh batch of chickens uses them. The usual types of disinfectants should not be used as they have practically no effect on coccidia. Neither can the use of a blowlamp flame be recommended to disinfect floors as it has been shown that it is only effective after prolonged application.

The two effective disinfectants are (a) household ammonia (10 parts ammonia to 100 parts of water) and (b) caustic soda (1 lb. caustic soda to 10 gallons boiling water).

Before attempting to disinfect, the floors should be thoroughly scraped clean and swept.

In addition to the above measures several drugs are now available, which when added to the feed, will give a good measure of protection against the development of an outbreak. They also enable the chickens to develop a good immunity. The main drugs in use at present are sulphaquinoxaline and nitrofurazone ("Nefco"). Details of their use are given below.

## TREATMENT

If an outbreak develops it is essential to immediately commence treatment on a flock basis. Several drugs can be recommended and details of their use are given below.

Sulphamezathine, sulphamerazine, sulphaquinoxaline and nitrofurazone are the drugs at present recommended. Sulphapyrazine and sulphadiazine are effective but ruled out on cost and availability. Sulphaguanidine is of limited use.

Many other treatments have been suggested from time to time but none compares favourably with the above.

It must be stressed that if satisfactory results are to be obtained from treatment the control measures set out above under "Prevention" must also be carried out. In addition, any birds which die should be destroyed by burning.

Treatment should commence early if heavy losses are to be prevented.

## THE USE OF DRUGS

In the prevention and treatment of coccidiosis, as outlined above, one of the drugs recommended is used as follows:

**A. For the Treatment of an Outbreak.**

(1) Sulphamezathine (sulphadimidine) 0.2% of the water for 3 days, untreated water for the next two days, then another 3 days on treated water. Sulphamezathine may be purchased as a 16% solution and used at the rate of 2 fluid ounces per gallon of water. If the sulphamezathine solution proves unpalatable the dose rate may have to be halved for a few days.

(2) Sulphaquinoxaline 0.04% of the water, given for three periods of two days each, each period being separated by a 3-day period on untreated water (i.e 2 days on, 3 off, 2 on, 3 off, 2 on, then normal water supply resumed).

(3) Nitrofurazone 0.22% in the feed or the equivalent amount in the drinking water for 7 days, administered continuously. This level can be obtained by mixing "Nefco" at the rate of 1 lb. "Nefco" per 250 lb. of mash, or adding 1 tablespoon of "Nefco" per gallon of water.

**Note.**—As chickens affected with coccidiosis tend to lose their appetite it is better to treat through the water. The amount of water 100 chickens will drink is about 1½ gallons per day when four weeks old and about 2½ gallons per day when three months old.

No other water should be available during the period of treatment and metal water containers should not be used.

**B. For the prevention of outbreaks in chickens running on moderately contaminated floors or yards (for example, following an outbreak in previous batch of chickens). Treatment should commence as soon as the chickens are put into the pens.**

(1) Sulphamezathine 0.4% of the feed or 0.2% of the drinking water for one day followed by half this amount (0.2% or 0.1% respectively) for the next 6 or 7 days.

(2) Sulphaquinoxaline 0.05% of the feed or 0.025% of the water for 4 days each week for 2-4 weeks.

(3) Sulphaguanidine 0.5% of the feed daily for two weeks.

(4) Nitrofurazone 0.011% of the feed, obtained by using "Nefco" at the rate of 1 lb. "Nefco" per 500 lb. of feed; or 1 tablespoon of "Nefco" for each 2 gallons of water if fed through the drinking water.

**C. For the prevention of coccidiosis in very lightly contaminate runs, where no previous outbreaks have occurred.**

(1) Sulphaquinoxaline 0.0125% of the feed, every day for 70 days, commencing when one day old.

(2) Nitrofurazone: "Nefco" fed at the rate of 1 lb. per 1000 lb. feed or 1 tablespoon per 4 gallons of drinking water, fed from one day old for 70 days.

Breeders: **Australorp, W/Leghorn, 1st Cross.**

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# WATERS FOR AGRICULTURAL PURPOSES IN WESTERN AUSTRALIA

By Officers of the Department of Agriculture and the Government Chemical Laboratories.

**THE nature of water which stock will drink varies greatly with circumstances and conditions. In this State the variation between the summer and winter salinity of the same water supply may be very great, and if stock have been accustomed to watering from one source, the gradual increase of salinity which occurs with increasing summer concentration may pass unnoticed by the animals, who become accustomed to it and suffer little ill effects. If, however, stock which have been accustomed to drinking fresh water, are suddenly put on to a very salt supply, it may be quite distasteful to them, and they may either refuse to drink it or suffer ill effects from its use. Stock, if thirsty through travelling, or under extreme conditions may take and thrive for a short period on very saline water from which they would suffer if used continuously.**

Such factors as these make the question more complicated than at first appears, and although certain standards of composition are recorded, their application cannot be entirely rigid. Water containing less than 300 grains total salts per gallon can be used continuously by all farm livestock. Sheep can tolerate water which is much more saline than that suitable for cattle, and cattle are more resistant than horses and pigs.

The standards at present in use in this State as the safe upper limits of total salts in water for stock are:—

| | Grains per gallon. |
|---|---|
| Poultry .... .... .... | 200 |
| Pigs .... .... .... .... | 300 |
| Horses .... .... .... | 450 |
| Cattle (Dairy) .... .... | 500 |
| Cattle (Beef) .... .... | 700 |
| Adult Dry Sheep .... .... | 900 |

(437.5 grains = 1 oz.)

These total salts include common salt (sodium chloride), gypsum (calcium sulphate), Epsom salts (magnesium sulphate), Glauber's salts (sodium sulphate), bicarbonate of soda lime and magnesia.

In the agricultural areas of Western Australia about three-quarters of the total salts is common salt. The proportion of common salt is less in the pastoral areas and the northern part of the State.

When the total salts exceed these amounts, only practical tests will show whether the water can be used without ill effects, because varying conditions vary the allowable maximum amount of soluble salts.

Where green feed is available, the animals can tolerate more saline water than when "bush or scrub" is the only feed. Sheep have been known to live on water containing up to 1,300 grains per gallon of total salts for short periods, but success cannot be forecast with water so saline. Further, older and dry sheep can tolerate waters more saline than can young, growing sheep (weaners) or breeding ewes, and similarly for other stock. Lambs, weaners and ewes in milk should be kept under observation if drinking water containing more than 700 grains of total salts per gallon. Horses not at work can be kept alive on a more saline water than can horses at work.

As indicated in the table, dry or beef stock can tolerate a more salty water than can milking cows. However, waters with much less salts than the maximum of 500 grains per gallon given in the table will reduce the milk production of high yielding cows.

Although water may be too saline for use alone, it may be mixed with good water to lessen the drain on the good supply, e.g., when water carting is neces-

sary. The proportions for mixing can be calculated from the soluble salts content of the two waters.

**Mixing with a fresh water is the only practical and economic method at present available for utilising saline waters.**

## WATER FOR IRRIGATION

The use of water for irrigation and domestic gardens is influenced not only by the amount of saline material dissolved in the water, but also by the type of soil and drainage, the climate and the rainfall. Much of the unsuitability of saline waters is due to the accumulation in the soil of the salts from the water applied.

The following remarks should therefore be taken only as a general guide, and it is emphasised that where the waters approach the maximum salinity for particular plants or where there exists special conditions of drainage, soil types, rainfall, etc., only practical tests will indicate the suitability of the water for the use in question. A more saline water can be used successfully on a well-drained light soil, than on a poorly drained heavy soil. Similarly a more saline water can be used in districts of high, though seasonal, rainfall, as the rain washes down the salts accumulated in the soil.

In general, where the drainage is good, water containing up to 70 grains total salts per gallon is suitable for growing all types of plants, including the salt susceptible plants.

Water containing up to 150 grains total salts per gallon, is suitable for growing most plants other than those susceptible to salt. Water containing up to 220 grains total salts per gallon, has been used for growing tomatoes, lucerne and cabbage and other salt resistant plants.

Above these limits, care should be taken to observe closely the growth and condition of plants or herbage, and if considered necessary, to obtain advice from the officers of the Department of Agriculture.

**Generally, however, 220 grains of total salts per gallon is regarded as approaching the maximum for safe watering of any plants. With such salt content, the drainage should be excellent and each watering should be of sufficient quantity to leach accumulated salts to a level below the root zone.**

In the case of nearly all underground waters, it is advisable to apply by furrows or by flooding rather than by sprinkling.

Where irrigation is not continuous, i.e., if the water is applied very infrequently, or only for short periods during the year then a water rather more saline than the above standards can be used.

### Salt Tolerant Plants.

Artichoke, asparagus, beetroot, buffalo grass, cabbage, cauliflower, celery, cotton, couch grass, cucumber, date palm, fig, Kikuyu grass, lucerne, mangels, melons, olive, *Paspalum vaginatum*, pumpkin, rhubarb, silver beet, spinach, tomatoes, Wimmera ryegrass.

### Salt Susceptible Plants.

Apricots, carrots, citrus, French beans, grape vines, maize, parsnips, peach, peas, potatoes, radishes, and seedlings.

**There is no sharp, clear-cut dividing line betwen suitable and unsuitable water for either plants or animals. Just as plants and animals may under favourable conditions continue to live with waters more saline than the figures quoted, so growth and production will in general decrease as the salinity of the water approaches the various upper limits quoted.**

## GENERAL

1. For general domestic use and for human consumption on individual farms the safe upper limit of total soluble salts is considered to be 150 grains per gallon. The water should be clear, colourless and odourless and free from pollution or contamination by organic matter.

Generally, as the total soluble salts increase, so does the hardness of the water, *i.e.*, the more difficult it is to obtain a lather with soap, and the more curd there is formed with soap.

Water containing up to 300 grains per gallon may be used for showers and baths especially if a salt water soap is used, and water containing up to 700 grains per gallon may be used in a septic tank system.

2. Natural waters may be acid (sour) (like diluted lemon juice or vinegar) or alkaline (like a weak solution of washing soda) or neither, that is, neutral.

3. Acid waters have a rapid corrosive effect on iron, such as pipes and tanks, and acidity should be corrected by the addition of good quality builder's lime, the quantity depending on the degree of acidity. The required amount of lime should be mixed to a thin milk with water and this milk mixed thoroughly with the bulk of the water. It is advisable to allow time for any solids in the water to settle out before drawing off clear water. After liming it is desirable to aerate the water (by splashing) before use to remove any excess lime. The lime may be added direct to a well.

Limestone may be used instead of builder's lime but takes longer to act. The limestone can be placed in the well, for example, as a cairn around the end of the intake pipe, or may be hung in a perforated bucket under the pipe entering the tank.

4. Some waters, particularly acid waters, may contain iron in solution and the addition of lime to correct the acidity will throw this iron out of solution as a sludge, which should be allowed to settle and the clear water used.

Waters containing iron compounds in solution may be clear and colourless when first drawn but become cloudy or deposit brownish yellow iron rust on standing, due to the action of the oxygen of the air on the iron compounds.

5. Water may contain hydrogen sulphide (sulphuretted hydrogen) a poisonous gas with a very objectionable odour similar to that of rotten eggs. This gas can be removed by aerating the water, the most convenient method usually being to allow the water to splash freely into the tank, e.g., by using a splash board under the pipe entering the tank.

Water which is coloured yellow or brown by organic matter in solution is satisfactory for stock and irrigation.

6. The clearing of muddy water by settling can be assisted by the use of kopi, powdery gypsum, at rates up to 4lb. per 1,000 gallons of water, or by the use of good quality builders' lime at rates up to 4oz. per 1,000 gallons. If kopi is not available, plaster of Paris, well stirred with 10 times its weight of water may be used. If the water is a good one then common salt may be used to assist clearing, remembering that adding 1lb. of common salt per 100 gallons of water adds 70 grains per gallon to the total salts present.

7. The salinity of ground water, particularly surface or shallow supplies, may change with time. It is not possible to forecast whether such change will occur, or whether the salinity will increase or decrease except that frequently there is an increase in salinity as the summer advances and a decrease during winter.

## SAMPLES FOR ANALYSIS

Samples of water for stock, irrigation and domestic purposes, are analysed by the **Government Chemical Laboratories, Adelaide Terrace, Perth,** on compliance with the following:—

A. Each sample should—
   (a) Be approximately one pint of water in a clean container which has been previously rinsed with the water to be tested.
   (b) Be clearly marked with the sender's name, address and date of sampling.
   (c) Be securely packed and addressed to the **Government Chemical Laboratories.**

B. At the same time, a letter should be forwarded stating—
   (a) That the applicant is a bona fide farmer, market gardener, grazier, etc., and that the analysis is required in connection with his business as such;
   (b) The source of the sample, e.g., bore, well, spring, etc., and its depth, and the location number of the property from which the sample was obtained.
   (c) Enclosing the fee of 7s. per sample. This fee applies only to those who qualify under paragraph (B) (a) otherwise the fee is £1 1s. per sample.

Should the analysis be required very urgently, this should be stated in the letter and the cost of a telegram added to the fee, when a telegram will be sent immediately the analysis is completed.

# PLANT QUARANTINE

**AUSTRALIA is most fortunate in still being free from many diseases and pests of important crop plants which do serious damage in other countries unless controlled by expensive control programmes. It is in the best interests of Australia that we should maintain this position as long as possible, but rapid transport of plant material from overseas, which is part of air travel development, makes this increasingly difficult.**

For these reasons, conditions governing the importation of all plant material are laid down under regulations, gazetted by proclamations and Statutory Rules, under the Quarantine Act, 1908-1950.

Plant material can only be landed at special ports of entry and cleared from Customs after examination and such treatment as is considered necessary by Plant Quarantine inspectors.

The State Departments of Agriculture operate this inspection service under the control of a Chief Quarantine Officer (Plants) in each State, for and on behalf of the Commonwealth Department of Health.

From the State Department of Agriculture details of plant quarantine regulations in respect of any plant which it is desired to import may be obtained, but the following outline will indicate some general principles:—

1. Some plants are totally prohibited, e.g., chestnuts, elms, broom millet, peanut plants, avocado plants, weed seeds, trees of stonefruits, apples, pears and citrus from certain countries.
2. Others are imported only under special safeguards, e.g., sugar cane, banana offsets, budwood of stone fruits from North America, Citrus from any area where Citrus canker is present, apples and pears from areas where fire blight occurs, potato tubers, grapevines, seeds of maize and sweet corn.
3. Others require a special permit, e.g., Nursery stock, peanuts, seeds of soya beans, flax, tobacco sorghum, beans, tomato.
4. Others may be imported only under certain conditions, e.g., bulbs, hops, raw cotton, logs and timber from areas to North of Australia.
5. Other plant materials are allowed entry subject to examination at port of entry (and treatment if necessary), e.g., nuts, dried fruits, seeds of most vegetables, grasses and clovers, timber cases, raffia and cane.

N.B.—It must be emphasised that the above list is incomplete. Consult your local Department of Agriculture for further details.

**REMEMBER!**

Every plant importation involves a risk of introducing some pest or disease or weed which may harm Australia's primary industries. There are safe ways of importing the best new varieties of plant novelties—through Plant Quarantine.

There are State Quarantine Regulations affecting the movements of fruit, plants and vegetables which may spread pests and diseases. Entry of certain plant material to a State or a specified area within a State is in some instances prohibited under State control. Where it is possible to move plants safely, ensure that they are properly certificated.

**KEEP AUSTRALIA CLEAN BY PLANT QUARANTINE**

# TREES OF WESTERN AUSTRALIA

By C. A. GARDNER, Government Botanist.

## No. 28—FOUR NORTHERN BLOODWOODS

**"BLOODWOOD" is the name given to a number of trees which have certain characteristics in common. The bark varies from smooth throughout, or with small adherent spots or patches of reddish, subpersistent bark to a rough, reddish-brown bark which is more or less friable, so that when rubbed by the hand, the surface layers become detached in the form of small fine splinters. The timber is red, and the leaves have either a widely divergent, almost transverse nerve pattern, or the venation is open and netted. The fruits are woody and globular to urn-shaped, with large, often winged seeds.**

In the field, the many species of *Eucalyptus* are capable of a rough classification into groups according to bark. Although this character varies to a certain extent from district to district, or from one soil type to another, it does serve as the basis of a very useful classification. Thus the terms Ironbark, Box, Blackbutt, Bloodwood, Stringybark, Gums, and many others are used to designate groups of Eucalyptus species which have similar bark characteristics. Amongst the Eucalyptus species of the south-west the Marri *(E. calophylla)* represents an extreme form of Bloodwood. Jarrah *(E. marginata)* on the other hand is a typical stringybark while *E. patens* is a blackbutt.

The Bloodwood group consists very largely of species which are northern in distribution and their identification has long been a difficult matter. This is due mainly to the paucity of material available for study, as many of the species occur in inaccessable country where few botanical collections have been made. During recent years, however, field work in connection with the Kimberley Horse Disease investigations has presented an opportunity for extensive collections of these little-known species. These specimens, together with those obtained by the botanists of the C.S.I.R.O. Land Research & Regional Survey Section, have now made possible a better understanding of this difficult group.

The greater number of *Eucalyptus* trees in our tropical areas are either gums, i.e. entirely smooth-barked trees, or bloodwoods, and they show a preference for the looser sandy soils. The species depicted here possess no common names, and so are referred to under their scientific nomeclature.

*Eucalyptus setosa* is a common bloodwood of the Pindan between Broome and Derby, but extends southwards to the Ashburton River. It is a small crooked tree rarely exceeding 20ft. in height, and receives its name "setosa" from the bristly hairs found on the younger foliage and flower buds. This character which is an unusual one in the genus, makes the species easily recognisable in the field.

*Eucalyptus zygophylla* is a larger tree found between Derby and Anna Plains on the 80 Mile Beach, but not extending far inland. It much resembles *E. setosa,* but has no bristly hairs, and the leaves have a close parallel secondary nervation. In both species the leaves possess no stalk. It is very close to *E. perfoliata* (illustrated in the last number), but the leaves are

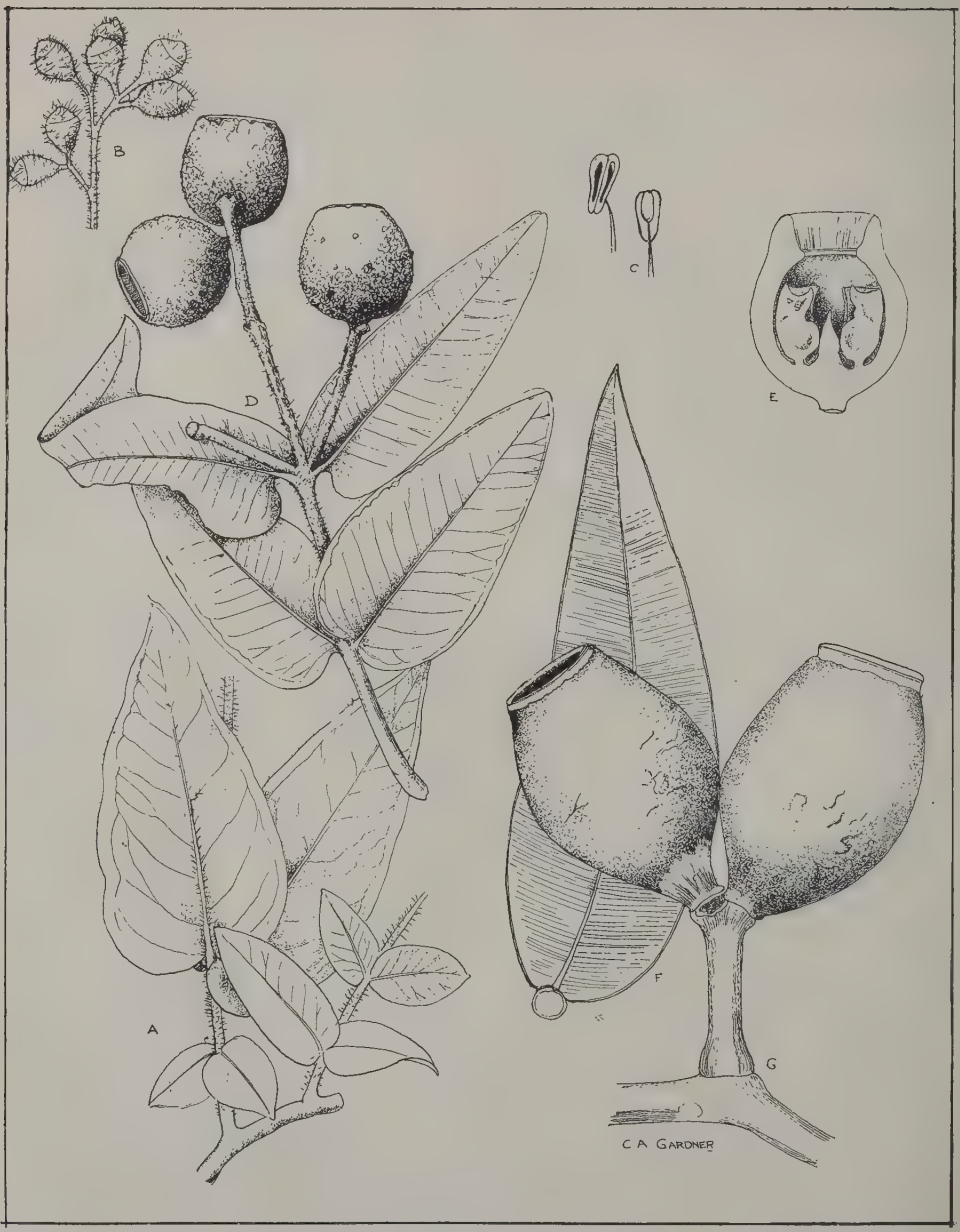


PLATE 1.—*Eucalyptus setosa Schau.* A—Young foliage; B—Buds; C—Anthers; D—Adult foliage and fruits; E—Section of fruit.
*Eucalyptus zygophylla* Blakely. F—Leaf; G—Fruits.

smaller and not united at the base, and it is a much larger tree, attaining a height of 40ft. or more. It is a common tree between Derby and Yeeda on the lower Fitzroy River.

The two species *E. ferruginea* and *E. abbreviata* appear to be restricted, in Western Australia, to the region of the Ord River. In these two species the leaves are a yellowish-green, and covered with a close reddish scurf, at least when young. The differences between the two are very slight, and somewhat inconstant. They would perhaps be best considered as one species under the name *E. ferruginea*. Both trees are small and straggling in growth with rough friable bark, and little is known of their occurrence and distribution in Western Australia.

## BOTANICAL DESCRIPTIONS

*Eucalyptus setosa* Schau.

A small to medium-sized tree, 15-40 ft. tall; bark rough-scaly on the trunk and branches; timber reddish, moderately hard and tough.

Leaves opposite i.e. two leaves arising at the same level on the branchlet, thick, spreading stiffly, stalkless, and with the bases produced into stem-clasping lobes. Ovate to lanceolate in shape, more or less hairy and 2-4 inches in length and a little more than 1 inch in width. The midrib prominent, the secondary nerves diverging at an angle, the intramarginal nerve sometimes indistinct and close to the margin.

Umbels 2-3 flowered arranged in a corymbose inflorescence. Peduncles terete and not flattened, up to 1 inch in length and setose with bristly hairs. Buds globular to pyriform, pedicellate, thickly covered with bristly hairs, and approximately one half inch in length and width. Opercumlum (bud cap) hemispherical, not half as long as the calyx tube. Anthers rather large, oblong, lobed at the extremity, the cells splitting down the whole length when liberating the pollen.

Fruit oviod to urn-shaped, up to one inch wide and long, and more or less rigid-hairy when young, but becoming glabrous, 3-5 locular, the valves deeply included. Flowering season May and June.

*Eucalyptus zygophylla* Blakely.

A small to medium sized tree up to 40ft. tall, with persistent bark; branchlets terete and glabrous.

Leaves opposite, i.e. two arising at the same level on the branchlet, without stalks, and with the same basal lobes as E. setosa. Ovate-oblong to lanceolate, thick leathery, and without hairs, up to six inches in length and sometimes more then one inch in width. Midrib prominent, the secondary nerves fine and almost at right angles to the midrib, the intramarginal nerve fine and close to the margin.

Umbels 3-5 flowered arranged in a short terminal corymbose inflorescence, the peduncles elongated, robust and usually much enlarged under the fruit. Buds with a more or less turbinate calyx tube about half an inch in diameter, and with a short operculum or bud cap. Anthers smaller than those of the related species. Fruits woody, subglobose or urn-shaped, nearly two inches in length and 1 inch in width, with a very thick rim. 4-5 locular with deeply enclosed valves. Seeds with a long terminal wing. Flowering occurs during February.

*Eucalyptus Ferruginea* Schau.

A medium sized tree of 30-40ft. in height with a usually widely spreading crown. Bark on the trunk grey, shortly fibrous and flaky. Twigs, foliage and inflorescence covered with a close dense rusty-coloured indumentum of small, more or less branch or star-shaped scales mixed with short bristles, the indumentum tending to wear off with age, the plant then often becoming somewhat silvery.

Leaves opposite, without or with only short leaf stalks, lanceolate in outline with a lobed or heart-shaped base, up to 7 inches in length and two inches in width. The midrib prominent, the secondary nerves very few, curved, with smaller anastomosing nerves between them; intramarginal nerve not evident.

Umbels 3-6 flowered, in large, terminal, corymbose inflorescence. Buds scaly, more or less pyriform, up to one half inch in length, operculum short. Anthers obovate, attached by the middle, the cells long and broad. Fruit ovoid to cup-shaped with a

PLATE 2.—*Eucalyptus ferruginea*, Schau. A—Leaves; B—Inflorescence and flower-buds; C—Anthers; D—Fruits; E—Section of fruit; F—Seed (enlarged).
*Eucalyptus abbreviata*, Blakely et Jacobs. G—Branchlet with leaves and fruit; H—Flower-buds; I—Section of fruit; K—Seed (enlarged).

rather thin rim, 3-5 locular with deeply enclosed valves. Seed with a terminal wing. Flowering season January-February.

*Eucalyptus abbreviata* Blakely et Jacobs.

A small tree up to 20ft. in height with a deeply furrowed and flaky persistent bark. Timber dark red.

Leaves opposite, or more or less so, without stalk or very shortly stalked, thick, rigidly coriaceous, yellowish green, paler on the lower surface, and more or less covered with a fine rusty tomentum or almost glabrous, narrowly ovate to lanceolate, 7-8 inches in length. Midrib distinct, the intramarginal nerve irregular, and close to the margin.

Umbels 3-5 flowered in an abbreviated corymb. Buds obovoid, slightly scurfy and about ½ inch in length, with a short operculum. Anthers oblong, attached in the middle, the parallel cells opening in longitudinal slits. Fruit thick and woody, broadly urn-shaped, up to 1½ inches in length with a thick obtuse rim; 4-5 locular, the valves deeply enclosed. Seeds with a terminal wing. Flowering season July and August.

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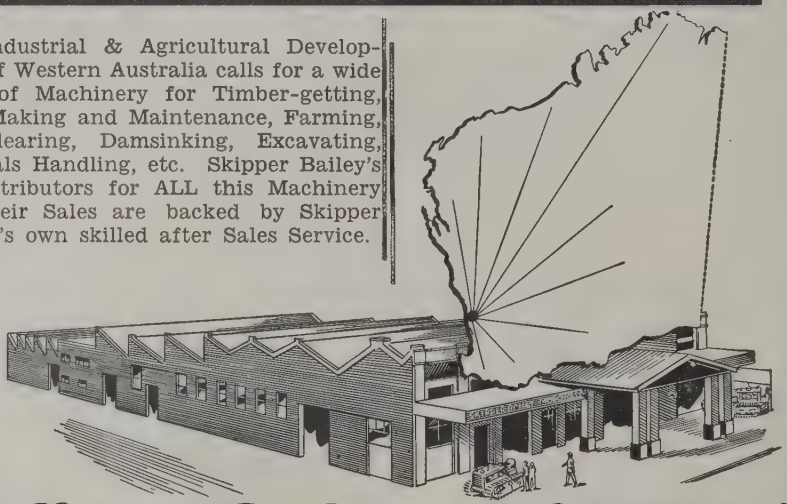

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# SOME CHEMICAL TRIALS WITH DOUBLEGEE

***(Emex Australis)***

By G. R. W. MEADLY, M.Sc., Officer in Charge, Weeds and Seeds Branch,
and G. A. PEARCE, B.Sc. (Agric.), Botanist.

**THERE is no more troublesome weed in Western Australia than doublegee. Besides its competitive and smothering effect on crop and pasture, the spiny fruits penetrate the hoofs of stock causing lameness. It is a quick-growing annual which forms seeds at an early stage of growth and rapidly develops a strong tap-root. Dormant seeds will continue to germinate for a number of years and a succession of germinations often occur in the one season. The seedlings are capable of surviving adverse conditions and making rapid recovery.**

The hormone-like weedkillers have given such spectacular results with wild turnip and wild radish that their use for the control of doublegees is often under discussion. The habit of the plant, and the fact that it is an annual, gave reason to believe that it would be susceptible to moderate rates of application and trials were commenced by the Department when the chemicals first became available several years ago. Unfortunately the doublegee belied its appearance and results have not been very encouraging.

Farmers have claimed varying degrees of success with the use of different 2,4-D formulations and some of our trials have caused a marked suppression of growth and given partial control. After many detailed investigations extending over several years, however, we are unable to recommend a treatment that is likely to give consistent results and destroy a high proportion of the plants. This does not mean that in some cases spraying is not warranted in order to reduce the competitive factor of the weed, but even with the most effective treatments many seeds mature to supplement the reserve remaining in the soil.

Although our work has been largely negative it has answered many questions and the experiments are described in order to place on record the basic work which has been done, as doublegee is a problem in places other than Western Australia.

It is not intended to discontinue experimental work against this weed as there is every chance that a formulation will be produced having a greater lethal effect and penetrating capacity. There is some evidence that two sprayings a few weeks apart are more effective than the single application and a trial to investigate this aspect is now in progress.

Results with Dinoc (30 per cent. sodium dinitro-ortho-Cresylate) have already been recorded*. A high degree of control of seedling doublegees was obtained by spraying with a solution of Dinoc in water in the proportion of 1:100 by volume. Two pounds of sulphate of ammonia was added to each 100 gallons of solution. In the case of small plants, satisfactory results were obtained with applications of 100 gallons per acre and although cereals were "tipped" to a certain extent no permanent injury was caused.

This method has been used for the control of doublegees in cereal test rows at Research Stations but is scarcely practicable for extensive areas for two reasons. Firstly, the cost of chemical exceeds 30s. per acre and secondly, high volumes must be applied, calling for large quantities of water and making low volume equipment unsuitable for application.

Other chemicals such as sodium chlorate and arsenic pentoxide can be used for

*"Recent Trials with Selective Weedkillers"—G. R. W. Meadly, Journal of Agriculture, Western Australia, Vol. XXIV, No. 1, March, 1947.

the destruction of small patches of double-gees but are not selective in action and destroy other herbage.

Since the advent of hormone-like herbicides a number of trials have been undertaken with doublegees growing in pasture and in crop. The results of some have been assessed by visual observation while others including those referred to below have been based on plant counts made on replicated plots.

**Trial 1—Northam.**—The amine salt, ethyl ester and butoxy-ethanol ester were applied to doublegee in a poor subterranean clover pasture at the rates shown in Table 1.

TABLE 1.

| Treatment No. | Type of chemical. | Ounces acid equivalent per acre. | Water gallons per acre. | Percentage Control. |
|---|---|---|---|---|
| 1 | 2,4-D amine .... | 6 | 4 | 4 |
| 2 | 2,4-D amine .... | 6 | 8 | 5 |
| 3 | 2,4-D amine .... | 12 | 4 | 5 |
| 4 | 2,4-D amine .... | 12 | 8 | 5 |
| 5 | 2,4-D amine .... | 16 | 4 | 7 |
| 6 | 2,4-D amine .... | 16 | 8 | 7 |
| 7 | 2,4-D ester .... | 6 | 4 | 4 |
| 8 | 2,4-D ester .... | 6 | 8 | 5 |
| 9 | 2,4-D ester .... | 12 | 4 | 8 |
| 10 | 2,4-D ester .... | 12 | 8 | 16 |
| 11 | 2,4-D L.V. ester | 6 | 4 | 8 |
| 12 | 2,4-D L.V. ester | 6 | 8 | 12 |
| 13 | 2,4-D L.V. ester | 12 | 4 | 20 |
| 14 | 2,4-D L.V. ester | 12 | 8 | 20 |
| 15 | Control .... .... | .... | .... | .... |

The doublegee plants ranged in size from 2 in. in diameter with only cotyledon leaves, up to 4 to 6 in. in diameter. Spraying was carried out in cool and cloudy weather and 30 points of rain fell during the night following application. The figures in the control column are the percentage of plants killed. A high proportion of those present were affected to a greater or lesser extent but later recovered.

**Trial 2—Beverley.**—The chemicals included in this trial were the amine and ethyl ester of 2,4-D. Each was applied at rates of 8, 16 and 24 ounces of acid equivalent in eight gallons of water per acre. The doublegees were uniform in size and 2 to 3 in. in diameter and were growing on land cropped the previous year. The weather was cold and clear and no rain fell for several days after spraying.

Although the growth of the double-gees was suppressed to a certain extent on all plots, the maximum control was 10 per cent. with 24 oz. acid equivalent of ester per acre. Table 2 summarises the results.

TABLE 2.

| Treatment No. | Type of chemical | Ounces acid equivalent per acre. | Water gallons per acre. | Percentage control. |
|---|---|---|---|---|
| 1 | 2,4-D amine .... | 8 | 8 | 0 |
| 2 | 2,4-D amine .... | 16 | 8 | 2 |
| 3 | 2,4-D amine .... | 24 | 8 | 5 |
| 4 | 2,4-D ester .... | 8 | 8 | 2 |
| 5 | 2,4-D ester .... | 16 | 8 | 5 |
| 6 | 2,4-D ester .... | 24 | 8 | 10 |
| 7 | Control .... .... | .... | .... | .... |

**Trial 3.**—The amine salt and ethyl ester were applied to doublegees in a crop of oats at Merredin. Each chemical was used at 4, 8 and 16 oz. acid equivalent in both 4 and 8 gallons of water per acre. Unfortunately the time of application was delayed, the crop being up to 18 in. high and some of the doublegees more than one foot across. The weather was fine and no rain fell for several days after spraying. No treatment gave a significant degree of control but the experiment proved that the spraying of doublegees at an advanced stage of growth should not be considered.

**Trial 4.**—An aerial spraying trial was undertaken at Mingenew with the amine, ethyl ester and butoxyethanol (low volatility) ester of 2,4-D according to the following table:—

TABLE 3.

| Treatment. No. | Type of chemical. | Ounces of acid-equivalent per acre. | Water gallons per acre. | Percentage Control. |
|---|---|---|---|---|
| 1 | 2,4-D amine .... | 4 | 2 | 8 |
| 2 | 2,4-D ester .... | 4 | 2 | 12 |
| 3 | 2,4-D L.V. ester | 4 | 2 | 12 |
| 4 | 2,4-D L.V. ester | 6 | 2 | 20 |

The experimental area was sown to wheat and each plot consisted of 18 acres. The doublegees ranged in size from small seedlings to plants 6 to 8 in. across. The weather was ideal for aerial application being fine and mild with little wind. Shortly after treatment a high proportion of the doublegees showed formative effects, but mostly recovered. The percentage of plants killed is shown in the right-hand column of Table 3.

## REACTION OF DOUBLEGEES TO 2,4-D

Within a few days of spraying with 2,4-D doublegee plants usually show formative effects, these being most pronounced in the case of seedlings. The leaves tend to twist and become more erect and a swelling develops at the base of the stem. A splitting of the runners is a characteristic symptom, and the growth of the weed is generally depressed. Malformation and proliferation of floral parts also occurs.

Even with rates as low as 4 oz. acid equivalent per acre some of the smaller plants usually succumb. The degree of effect on the remainder is variable. The growth of some is scarcely interrupted while others, although showing obvious injury, make renewed growth from terminal growing points. Plants affected more severely form shoots from near the base of the stem. Those which recover produce a number of normal viable seeds.

## SUMMARY AND CONCLUSIONS

Various formulations of 2,4-D used at a wide range of acid equivalent levels have not proved really effective against doublegees and could not be considered as a

A normal doublegee plant on the right compared with a plant affected with 2, 4-D. Although the sprayed plant has received a check in growth and the characteristic swelling is present, it has not been killed.

means of eradicating this plant or even causing a reduction in establishment the following year.

As with a number of other weeds, somewhat better results have been obtained under crop than under pasture conditions. The spraying of doublegees in a crop, particularly when other susceptible weeds are present, could be an economical undertaking in areas where this weed is vigorous and strongly competitive. Although a high proportion of kill cannot be expected, 6 oz. of acid equivalent per acre of the ester of 2,4-D has caused suppression of growth for a period and could result in considerable advantage to the crop if applied when the weeds are small. Doublegees have been affected to a greater extent by the ester than by similar quantities of the amine or sodium salt of either 2,4-D or M.C.P.A.

The volume of solution applied does not appear to be an important factor as was suggested at one stage. Reducing the volume from eight to four gallons, applied with a low-volume boom caused no improvement and similar results followed the application of the same quantity of active chemical in two gallons per acre by means of an aircraft.

There is evidence to indicate that treatments are more effective in the northern portions of the wheatbelt, possibly associated with more rapid growth in the early part of the season. This apparent advantage is offset by the fact that in those districts doublegee tends to germinate over a longer period.

Chemicals of the growth regulating or hormone-like group are continually being tested for herbicidal properties and it is possible that a formulation will be prepared that will prove effective against doublegees.


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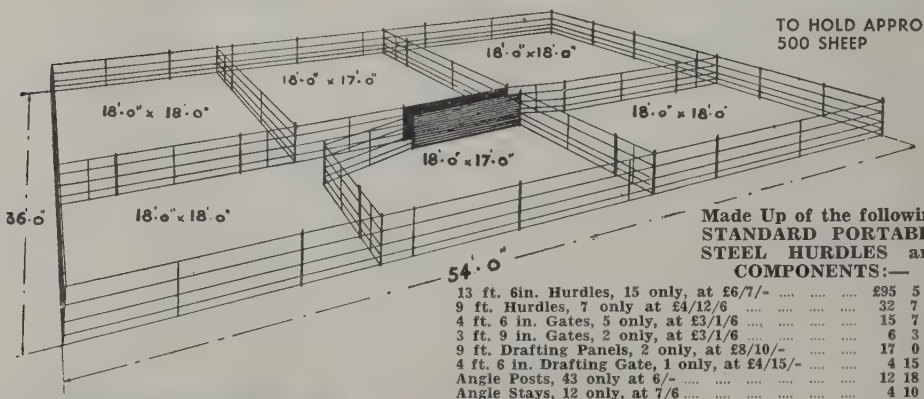


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# PLANT DISEASES

## BLACK SPOT (Anthracnose) OF GRAPES

### FURTHER EXPERIMENT WITH NEW UNGICIDES

By W. P. CASS SMITH, B.Sc. (Agric.), Government Plant Pathologist; H. L. HARVEY, B.Sc. (Agric.), Senior Plant Pathologist, and W. R. JAMIESON, Dip. Oen. (Roseworthy), Viticulturist.

**IN a preliminary experiment conducted at St. Alban's Vineyard, Upper Swan, during the 1952-53 season, excellent control of the serious black spot or anthracnose disease of grapes was obtained with some new spray materials. The results which were reported in this Journal (1) indicated that Ziram, Thiram and Captan fungicides were superior to standard copper sprays and their effectiveness for disease control was approximately in that order. As these spray materials were tested only in large scale unreplicated plots, the experiment was repeated again at Upper Swan last season and a smaller replicated trial was also conducted at Caversham to provide fuller information. The results have confirmed the findings of the first year's experiment in all essential details.**

Black spot, or anthracnose of grapes caused by the fungus *Elsinœ ampelina* is a serious disease which is widespread both in commercial vineyards and home gardens. It affects both yield and quality of fruit and most varieties are susceptible to a greater or lesser extent.

The disease may attack any part of the current season's growth and it first becomes obvious in the form of dark-coloured spots. On leaves and berries the spots develop greyish centres as they enlarge, and the margins become dark red or purplish black in colour (Figs 1 and 2). On canes, the spots develop into elongated or irregular cankers with pitted centres which expose the wood (Fig. 3).

As a result of infection, girdling of canes, leaf stalks, bunch stalks, and berry stalks commonly occurs, leading to the death of

Fig. 1.—Black Spot infection on leaf showing characteristic cracking of dead tissue and the subsequent development of holes in the leaf.

(1) Cass Smith, W. P.; Harvey, H. L.; Jamieson, W. R.; Journal of Agriculture, Western Australia. Vol. 2 (Third Series): 357-360, 1953.

distal parts beyond the lesion (see Leaflet No. 2057 for a fuller account of the symptoms of the disease).

The fungus largely survives from season to season in cankers on canes which were not removed during pruning operations.

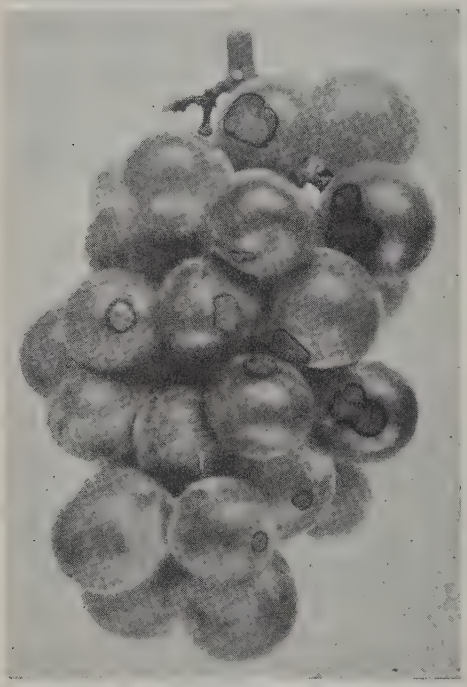

Fig. 2.—Black Spot infection of berries. Note the light coloured centres and the darker marginal areas.

Affected tendrils left clinging to the trellis wires are also a common means of carry-over (Fig. 4). With the advent of spring, the fungus in these cankers or spots becomes active once more, and produces myriads of minute spores which are disseminated by rain splash or heavy dews. When the spores lodge on the new spring growth, infection occurs, giving rise to the symptoms mentioned.

## FUNGICIDE EXPERIMENTS, 1953-54

### A—Upper Swan—St. Alban's Vineyard.

This experiment was repeated on the same site as the experiment conducted in the previous season (1). The identical Sultana vines and layout were used, the latter consisting of a large unreplicated trial to test four new types of fungicides against the standard copper fungicide (Bordeaux mixture). The plots in which each fungicide was tested, were contiguous and comprised three rows of 48 vines per row. For the purpose of black spot assessment, 12 vines were selected at random from the middle row of each treatment plot.

TABLE 1.

FUNGICIDE TREATMENTS.

| | Fungicide | Strength |
|---|---|---|
| 1. | P.M.F. (Phenyl Mercuric Fixtan) | Bud swell, 0.5 lb. per 100 gals.<br>Foliage, 0.25 lbs. per 100 gals. |
| 2. | Thiram (T.M.T.D.) | Bud swell, 3 lb. per 100 gals.<br>Foliage, 1.5 lb. per 100 gals. |
| 3. | Captan (S.R. 406) | Bud swell, 4 lb. per 100 gals.<br>Foliage, 2 lb. per 100 gals. |
| 4. | Ziram | Bud swell, 3 lb. per 100 gals.<br>Foliage, 1.5 lb. per 100 gals. |
| 5. | Bluestone (Copper Sulphate) Bordeaux Mixture | Bud swell, 20 lb. per 40 gals.<br>Foliage, 4-4-40. |

Throughout the season five applications of the fungicides were made at the following times:—

10th September, 1953—(Bud swell).

30th September, 1953—(Shoots 2 to 4 inches long).

20th October, 1953, 4th November, 1953—(Before flowering).

30th November, 1953—(After fruit set).

As dry weather conditions prevailed in the early summer it was not necessary to apply a late bunch spray.

**Results (Upper Swan).**

An assessment of Black spot infection on the foliage made on 16th December, 1953, showed that on Ziram and Thiram sprayed vines the amount of disease was slight and that control was *very* satisfactory. Vines sprayed with S.R.406 or Bordeaux mixture showed medium infection, while those sprayed with PMF were heavily infected (see Table 2).

On 8th March, 1954, the amount of disease present on ripe bunches was assessed when yields were taken (see Table 2).

Fig. 3.—Cankering of canes caused by infection with Black Spot.

TABLE 2.

SEVERITY OF BLACK SPOT AND YIELDS.

| Fungicide. | Severity Index (S.I.) 0–100. | | Green Yield (lb.). | |
|---|---|---|---|---|
| | Foliage (16-12-53). | Mature Bunches. (8-3-54). | Per Vine. | Per Bunch. |
| PMF .... .... | 68 | 29·3 | 9 | 0·64 |
| Thiram .... .... | 16 | 0·7 | 19 | 0·64 |
| Captan (S.R. 406) | 27 | 1·5 | 20 | 0·75 |
| Ziram .... .... | 12 | 0·5 | 21 | 0·74 |
| Bordeaux Mixture | 30 | 0·4 | 19 | 0·74 |

It will be seen from Table 2 that black spot was much more severe in the early part of the season than at picking time when the black spot hazard was not considered high enough to warrant a late bunch spray. Except where PMF was used and the disease had built up to very serious proportions, bunch infection was negligible. Yields reflect the same trend; they were low in the PMF plot but satisfactory and comparable in plots sprayed with the other fungicides. It will be noticed also that average bunch weights for all treatments are comparable. This indicates that the marked reduction in yield of the PMF treated vines was due to the damaging effect of the disease at the flowering or fruit setting stages which prevented bunch development.

## FUNGICIDE EXPERIMENTS

### B—Caversham (J. Duff & Sons).

In this experiment five fungicides were compared for their effectiveness in controlling black spot. The experiment was laid out as a randomised block of seven treatments, with four replications. Each treatment plot consisted of six sultana vines. Table 3 gives details of treatments.

TABLE 3.

FUNGICIDE TREATMENTS.

| FUNGICIDE | STRENGTH |
|---|---|
| 1. No treatment (control) | |
| 2. Thiram | Bud swell 3 lb. per 100 gals.<br>Foliage 1.5 lb. per 100 gals. |
| 3. Ziram | Bud swell 3 lb. per 100 gals.<br>Foliage 1.5 lb. per 100 gals. |
| 4. Ziram* | Bud swell 3 lb. per 100 gals.<br>Foliage 1.5 lb. per 100 gals. |
| 5. Captan (S.R. 406) | Bud swell 4 lb. per 100 gals.<br>Foliage 2 lb. per 100 gals. |
| 6. Zineb | Bud swell 3 lb per 100 gals.<br>Foliage 1.5 lb. per 100 gals. |
| 7. Copper oxychloride | Bud swell 5 lb. per 100 gals.<br>Foliage 2.5 lb. per 100 gals. |

* Whereas all the other treatments received five spray applications, the fifth and final application immediately after fruit set was omitted in this treatment.

Spray applications were made at the following times:—

14th September, 1953—Bud swell.

1st October, 1953—Shoots 2 to 4 inches long.

21st October, 1953, 5th November, 1953—Before flowering.

2nd December, 1953—After fruit set (Treatment 4 not sprayed).

As in the Upper Swan experiment, dry weather obviated the need for a late bunch spray application.

Fig. 4.—Black Spot infection of leaf, petiole, cane and tendril. Diseased parts left on the vine after pruning serve to carry the black spot fungus over from season to season. Affected tendrils often escape notice and remain attached to trellis wires.

**Results (Caversham).**

On 14th December, 1953, the severity of black spot on the foliage was assessed for each treatment and on 4th March, 1954, the severity of the disease on every bunch was assessed and bunch yields taken. Results are given in Table 4.

TABLE 4.

SEVERITY OF BLACK SPOT AND YIELDS.

| Fungicide. | Severity Index (S.I.) 0–100. | | Yield in ounces. Average per Plot (6 Vines). |
|---|---|---|---|
| | Foliage (14-12-53). | Mature Bunches (4-3-54). | |
| 1. No treatment (control) .... | 87·5 | 18·18 | 487 |
| 2. Thiram .... .... .... | 21·7 | 2·97 | 1,367 |
| 3. Ziram .... .... .... | 11·67 | 1·22 | 1,678 |
| 4. Ziram (see Table 3) .... | 12·5 | 0·67 | 1,708 |
| 5. Captan (S.R. 406) .... | 27·12 | 2·08 | 1,475 |
| 6. Zineb .... .... .... | 45·82 | 8·4 | 1,410 |
| 7. Copper Oxychloride .... | 53·32 | 5·13 | 1,350 |
| Least difference for significance at 99 : 1 level .... .... | 16·16 | 3·62 | 786 |

From the results of the Caversham experiment presented in Table 4, the following conclusions are noteworthy:—

All fungicides significantly reduced the disease both on foliage and bunches, and promoted higher yields than the untreated vines.

With the exception of Zineb, all treatments were better than copper oxychloride for controlling the disease on the foliage.

Ziram treatments (3 and 4) were the only ones which gave a greater reduction of the disease on mature bunches than the copper oxy-chloride treatment.

## CONTROL RECOMMENDATIONS

1. In experiments conducted during the last two seasons, Ziram and Thiram compounds have proved to be highly effective for the control of black spot or anthracnose and are now preferred to standard copper sprays. When these materials are used they should be applied as far as possible at the following stages, and concentrations.

(a) late dormant—budswell 3 lb. in 100 gallons.

(b) when shoots are 2-4 inches long 1½ lb. in 100 gallons.

(c) before flowering 1½ lb. in 100 gallons.

(d) after fruit set 1½ lb. in 100 gallons.

(e) thereafter at any time when wet weather conditions favour further black spot infections.

Where possible sprays should be applied with a power outfit at a pressure of at least 200 lb. Nozzles capable of delivering a good mist should be used, and all parts of the vine and tendrils remaining on trellis wires should be well covered with spray. Ziram and Thiram proprietaries should disperse readily in water, and remain dispersed during application without excessive agitation.

2. During Pruning.—Cut out all wood showing black spot cankers, and burn the prunings.

**ACKNOWLEDGMENTS**

Grateful acknowledgments are made to Woodsome Estates Pty. Ltd., who provided the large area of vines and machinery for conducting the St. Albans trials; and to Mr. R. Rodda and staff who gave every assistance.

Thanks are also due to Messrs. J. Duff & Sons, who provided the necessary facilities for carrying out the experiment at Caversham and gave helpful co-operation; and to the Forests Department for statistical analysis of the results of the Caversham experiment.

# BEAN RUST

**IN a report issued from the New South Wales Department of Agriculture last February (N.S.W. Agr. Gaz. 65:2:1954), the occurence of rust (Uromyces phaseoli typica) was reported on the hitherto rust-resistant Westralia runner bean when grown recently at Richmond, N.S.W. This outbreak was attributed to the development of a new rust race.**

The report, which received considerable local publicity, proved alarming to market gardeners here, and to the W.A. Department of Agriculture, who evolved the variety.

Since the report appeared, seed of the Richmond line of Westralia was obtained from the N.S.W. Department of Agriculture. When plants from this line of seed were tested here in the glasshouse,

Fig. 1.—One of the plants grown from seed of the reputed Westralia seed from Richmond in a glass-house test conducted in Perth. As will be seen from the photograph, they were highly susceptible to rust infection.

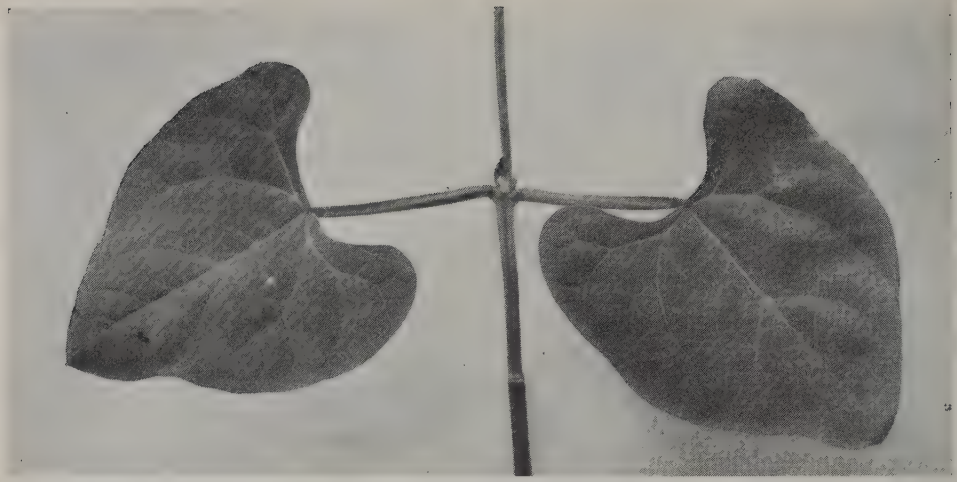

Fig. 2.—One of a number of plants grown under the same conditions but from Certified Westralia seed. These plants proved rust-resistant.

they proved very susceptible to rust (see Fig. 1), but plants from certified Westralia seed produced in this State were highly resistant to the disease (see Fig. 2).

**It is obvious therefore that the Richmond line of Westralia was not true to name.**

Tests were also conducted in New South Wales and similar results were obtained, according to information supplied by Dr. C. J. Magee, Chief Biologist of the New South Wales Department of Agriculture, who said that "It seemed likely that the Richmond strain reputed to be Westralia was not genuine. Plants grown from genuine Westralia seed obtained from a leading firm of New South Wales seedsmen have shown no sign of rust in glasshouse tests, where the Richmond strain proved highly susceptible."

Although the appearance of a new rust race is always to be feared, the Westralia variety apparently still maintains resistance to all known Australian races, at the present time.

In this State, because of the high rust hazard, the variety is widely grown in the autumn months in market gardens adjacent to Perth, and in winter by bean growers at Carnarvon.

According to reports, it has also proved rust-resistant in New Zealand and Rhodesia.

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# COBALT

## Its Use to Control "Wasting Disease"

By L. C. SNOOK, B.Sc. (Agric.), D.Sc., Animal Nutrition Officer

**COBALT is one of the most interesting of the so-called "trace" elements. Particularly is this so to West Australians as the use of cobalt has permitted farmers to rear healthy sheep and cattle where previously this was impossible. Also, it was in this State that Filmer and Underwood carried out much of the fundamental work which led to the discovery of the vital importance of cobalt.**

Minute traces of cobalt are essential in the diets of ruminants, that is in the food of animals which chew their cud. Only about one part of cobalt in every ten million parts of dry matter is present in average herbage but this seemingly insignificant trace **MUST** be present, otherwise sheep and cattle will waste away and eventually die.

Strangely enough, non-ruminants do not need cobalt. Horses and rabbits, for example, will flourish on cobalt-deficient pastures where sheep and cattle are dying. Apparently, cud-chewing animals need cobalt because this element is used by organisms which live in the rumen or paunch. These organisms seemingly build up certain nutrients vital to the welfare of sheep and cattle.

The essential cobalt must be obtained continuously from the diet. Reserves of cobalt which may be accumulated in the liver apparently are of no value. Thus sheep receiving 7 milligrammes of cobalt once a week remained in excellent health, sheep receiving 21 mg. once every three weeks were not so thrifty, while others receiving 35 mg. cobalt once every five weeks developed symptoms typical of cobalt deficiency and some died (Lee 1951).

### DENMARK WASTING DISEASE

Cobalt deficiency caused serious losses among dairy cattle in Western Australia when the coastal areas of the South-West were developed as group settlements after World War I. "Denmark Wasting Disease," as it was called, resembled "bush-sickness" which had caused similar losses in New Zealand and which was then assumed to be due to iron deficiency as it was cured by feeding an iron ore called limonite.

Tests showed that limonite would cure Denmark Wasting Disease also, but Filmer (1932) deduced that it was not iron which was needed by the animal but something present along with the iron. Subsequent work by Filmer and Underwood (1935, 1936) clearly demonstrated that the cobalt present in limonite was the curative principle.

Limonite is still used as a cheap practical source of cobalt to prevent "Wasting Disease" but pure cobalt salts are equally effective and, when available, can be cheaper.

### AREAS WHERE COBALT DEFICIENCY OCCURS

As far as we know, in this State cobalt deficiency is almost entirely restricted to the coastal areas, specifically to coastal country consisting of sand and limestone. Heavy clays and rich loams grow pasture containing adequate cobalt. Where alluvial silt has been deposited along creeks and estuaries cobalt deficiency is not a problem. The karri soils of the South-West appear to be an exception. In spite of the rich appearance and loamy texture of such soils, the pasture growing in karri country can be seriously lacking in cobalt. The cobalt status of some of the South-West jarrah-redgum country is also low.

Cobalt is not a plant food. This means that excellent pastures can be grown on soils deficient in cobalt. As occurred when "Wasting Disease" was a serious problem in the Denmark area, cattle and sheep could waste away in paddocks containing an abundance of green herbage of apparently excellent quality.

## SYMPTOMS OF COBALT DEFICIENCY

Sheep and cattle receiving inadequate amounts of cobalt develop "Wasting Disease." This is an excellent descriptive name because, in the absence of cobalt, ruminants lose their appetite and waste away. Affected animals become weaker, develop "weepy" eyes, and if not treated will die within three months to two years after symptoms are first noted. Both sheep and cattle often become anaemic.

Symptoms become apparent at any time of the year but are most obvious in the spring and early summer when green feed is abundant. Milk production in dairy cows is seriously reduced and sterility is common. Where deficiency is only marginal, the animals may only appear unthrifty, that is, they will become lean, develop harsh dull coats, and give the appearance of suffering from internal parasites. This unthriftiness may only be obvious among young stock in areas where the adult animals seem to obtain sufficient cobalt for their needs.

This has been illustrated during the last two years where breeding ewes have been taken into coastal areas by dairy farmers. The ewes remained in good health but the lambs were weak at birth, developed "weepy" eyes, and lost the desire to suckle the ewes. The administration of cobalt solution per medium of a spoon quickly restored the appetite, followed by complete recovery.

Filmer and Underwood (1936) in their original paper, give the following hints to assist in determining whether a disease characterised by loss of condition is "Wasting disease":—

1. Wasting disease occurs in the presence of ample feed, and is most common when the feed is green.
2. Horses are never affected with wasting disease.
3. Young cattle, especially those between six and 18 months, are more susceptible to wasting disease than mature cattle.
4. Sheep, and lambs especially, are more susceptible to wasting disease than young cattle.

Lack of cobalt in the diet can be determined by analysing the livers from suspected animals. As very little cobalt is present in a normal liver, however, special care has to be taken to avoid contamination with foreign material when collecting livers for investigation.

## "COAST DISEASE"

This is due to a dual deficiency of cobalt and copper. It occurs typically on the fine coastal sands and limestones developed from windblown shell. Light land further inland ("banksia sands") can also be affected.

Animals affected with "coastiness" generally die of "wasting disease" due to lack of cobalt before there is time for gross symptoms of copper deficiency to develop.

**Treatment.**

*Limonite Licks.*—Selected iron ore (limonite) containing at least 500 parts per million of cobalt is still used as a cheap and convenient source of cobalt for stock. Limonite is the major ingredient of Denmark Lick.

The original Denmark Lick contained linseed meal and di-calcic phosphate along with salt, limonite and bluestone. These ingredients together made a palatable, general purpose lick.

For reasons of economy, however, the Denmark Cobalt Lick now sold has been made more specific. It consists of two-thirds limonite and one-third common salt (plus copper sulphate). If sheep consume one ounce of this lick each week, or cattle one ounce a day any deficiency of cobalt (and copper) should be corrected.

At the present time (June 1954) Denmark Lick costs £17 2s. 6d. per ton (ton lots) at the superphosphate works. A single bag of 112 lb. costs about 19s. and is adequate for 30 cows for two months. Obviously it is sheer folly to run any risk of the serious losses associated with cobalt deficiency when the risk can be eliminated at such little cost.

Farmers can make up their own limonite licks by purchasing the limonite from the superphosphate manufacturers. This costs 25s. per bag of 180 lb. at the works. Where freight charges are heavy and stock salt is available on the property home made licks may prove a worthwhile economy. One ounce of limonite should contain enough for two sheep for a week or for two cows for a fortnight.

*Cobalt Salts.*—Cobalt chloride and cobalt sulphate can be cheap and convenient sources of cobalt for the farmer. Both salts are equally useful so the cheaper one should be purchased. Commercial salts are now available at rates ranging between 11s. and 14s. per pound. To make up a salt lick with the same content as Denmark Lick it is necessary to mix 2 oz. of cobalt chloride or cobalt sulphate with 100 lb. of stock salt. Thorough mixing is essential and it may be most convenient to dissolve the cobalt in water and sprinkle this over the stock salt before mixing.

*Compound Licks.*—Cobalt can be supplied in compound licks. The following is an example of a lick suitable for dairy cattle in coastal areas:—

1.—Denmark Lick—100 lb. (supplies cobalt and copper).
Stock salt—100 lb.
Bone meal or its equivalent—200 lb. (supplies calcium phosphate).

This lick could be fed to cattle at the rate of 4 oz. per day. It will supply all the minerals at present known to be deficient for stock in Western Australia and should cost no more than 15s. cwt.

On most properties the grazing animals obtain adequate copper through the pasture and a more simple lick may suffice, such as:—

II.—Cobalt chloride or cobalt sulphate—2 oz.
Stock salt—80 lb.
Bone meal or its equivalent—120 lb.

This will contain about the same amount of cobalt as Lick No. 1 and should be fed to cattle at the rate of 4 oz. per head daily.

## STOCK LICKS ARE OF LIMITED VALUE

Stock licks are of most value when a known amount can be mixed with the food fed to each animal. One can then be certain that the deficiencies of the diet are being corrected. When licks are placed in the field for stock to feed themselves, consumption can be very variable. Some animals will eat far too much, others none at all. Care should be taken to see that the licks are sufficiently palatable to attract all stock without being so tasty that greedy animals eat the lot. Salt is an excellent medium through which to supply mineral supplements. The proportion of salt should be varied to suit local conditions. For example, on many properties in the South-West dairy cows appear to dislike salt during some seasons.

## COBALT SOLUTIONS

Commercial cobalt salts can be dissolved in water and sprayed on to hay or the food being fed in the bails. Cobalt salts can also be added to the drinking waters. The amounts to be used can be based on the fact that one ounce of soluble cobalt salt contains enough cobalt for 1,000 sheep or 100 cattle for one week. Use of cobalt in the drinking water presents practical difficulties but on North-West coastal stations, for example, it is often the only method in use.

The necessary cobalt must be added to the drinking water at least once every week. On some stations the required amount of cobalt salt is wrapped up in cloth and placed in the bottom of the drinking trough. The cobalt slowly dissolves and treated water becomes available over a longer period. With experience in the degree of wrapping required this method can give good results. The cobalt salt (and bluestone, if needed) is sometimes packed into a length of copper piping in which several holes have been bored to permit the slow escape of the dissolved salt when the piping is placed in the water trough.

It is sometimes possible to treat storage tanks with cobalt salts. Whichever method is used it should be remembered that one ounce of the soluble cobalt salt will suffice for 1000 sheep or 100 cattle for one week. Thus if it is considered that each sheep will consume about five gallons of water in a week then one ounce of cobalt salt will be required for each 5000 gallons of water consumed.

*Drenching.*—As the dose must be given at least once a week it is not anticipated that cobalt will be given as a drench except under unusual conditions. Should drenching be necessary, however, dissolve one ounce of cobalt chloride or cobalt sulphate in 1 gallon of rain water. Keep this as a stock solution. For use, dilute the stock solution with an equal volume of rain water. Ten cubic centimetres (10 c.c.) of this dilute solution constitutes the weekly

dose for a sheep. Proportionate doses can be given to lambs or to cattle, according to body weights.

## SUPPLYING COBALT THROUGH THE PASTURE

In Britain and New Zealand it is a general practice to correct cobalt deficiencies in the pasture by topdressing with soluble cobalt salts. Cobalt is not a plant food but the traces which do get into the plant are adequate for the animal. In the past topdressing of pastures with cobalt salts has not been recommended in this State but under certain conditions it may be worthwhile. On cobalt-deficient sandy soil near Perth it was found (Rossiter et. al. 1948) that topdressing with cobalt sulphate at the rate of 4 oz. per acre resulted in "sound" pasture for two years.

At Glenroy in South Australia, Lee (1951) found that no lambs were lost on heavy black clay which five years previously had been topdressed with 1 lb. of cobalt sulphate per acre. Seventy per cent. of the lambs died from cobalt deciency on the untreated plots nearby. It seems, therefore, that where valuable animals are kept on highly improved pastures, relatively inexpensive topdressings every two or three years may eliminate the need for continuous treatment of food or water.

As lambs and calves are more susceptible than adult animals the topdressing of paddocks used for the rotational grazing of young stock may be justified. The topdressing of ten acres of pasture around a watering point may likewise safeguard stock grazing over a much more extensive area.

Superphosphate containing 5 lb. of cobalt sulphate per ton can be obtained on special order for an additional cost of about £3 10s. per ton. This would serve to apply 8 oz. of cobalt salt per acre over 10 acres. Many farmers would consider this well worth the cost if for two years or more it saved all the bother of feeding licks or treating drinking water.

Topdressing, also has the important advantage that all grazing animals receive the supplement independant of the rate with which treated water or lick is consumed. Top dressing could not be recommended on calcareous soils but trials will be well worth while on mnay South-West soil types.

## COBALT FOR YOUNG CALVES

Calves in cobalt-deficient country should receive a cobalt supplement from birth. A pinch of Denmark Lick is commonly added to the milk each day. Perhaps a more certain method is to dissolve 1 oz. of cobalt chloride (or sulphate) in a gallon of rain water. Add a teaspoonful of this solution to the feed once a day. When the calves are weaned either make Denmark Lick available, add cobalt to the drinking water or place the young stock on pasture topdressed with superphosphate containing cobalt.

If it is necessary to treat lambs for cobalt deficiency the same solution can be used but one teaspoonful daily will be ample for 10 lambs.

## SUMMARY

"Wasting Disease" in ruminants is due to lack of cobalt in the diet.

In Western Australia pastures deficient in cobalt are known only in the coastal areas.

Cobalt deficiency may be corrected by feeding limonite licks, by use of cobalt salts in the feed or drinking water, or by the application of cobalt salts to the soil.

If the ration is deficient in cobalt, ruminants cannot make use of cobalt stored in the body hence a continuous supply in the food is essential.

Cobalt can be supplied to stock in salt mixtures containing limonite or cobalt salts.

Drinking water can be treated to supply the necessary amount of cobalt.

Topdressing pasture with superphosphate containing soluble cobalt salts may be effective under certain conditions.

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# INSECT Pests AND THEIR CONTROL

By B. A. B. EDWARDS, B.Sc. (Hons.), Entomologist

## CONTROL OF TOBACCO PESTS IN W.A.

**RECENT experiments have shown that most of the local insect pests of tobacco can be controlled by DDT either as a 0.1% spray or as a 2% dust. The insects commonly found attacking tobacco plants in South-Western Australia are the leaf miner, the stem borer (budworm), cutworms, loopers, grasshoppers and wireworms. Minor damage is also caused by a variety of beetles and other insects.**

During the 1952-53 growing season, in co-operation with officers of the Tobacco Branch of the Department of Agriculture, an experiment was carried out at Manjimup to compare the effectiveness of various insecticide treatments against the major insect pests of the district.

The insecticides were first applied one week after planting out and thereafter at equal intervals during the remainder of the growing period (approximately four months). The effectiveness of three and five applications of each insecticide during the season was tested. Dusts were applied with a hand rotary duster and sprays with a knapsack spray pump. Application rates varied from 10 to 30 lb. per acre for dusts and 16 to 48 gallons per acre with sprays depending on the size of the tobacco plants.

The following table summarises the results of the experiment in which a total number of 8,950 leaves were individually examined. The results were divided into leaf miner damage and damage caused by other chewing insects.

| Treatment. | Average No. of Leaf Miners per leaf. | Per cent. leaves damaged by other insects. |
|---|---|---|
| 1. Control—no treatment .... | 2.20 | 25.8 |
| 2. 50 per cent. lead arsenate dust three applications .... .... | 1.29 | 18.1 |
| 3. 50 per cent. lead arsenate dust five applications .... .... | 1.16 | 15.6 |
| 4. 2 per cent. DDT dust—three applications .... .... .... | 0.83 | 12.2 |
| 5. 2 per cent. DDT dust—five applications .... .... .... | 0.42 | 7.7 |
| 6. 0.1 per cent. DDT spray—three applications .... .... | 0.42 | 9.8 |
| 7. 0.1 per cent. DDT spray—five applications .... .... | 0.28 | 5.9 |

The results of this experiment have been statistically analysed and will be published elsewhere.

These results show that DDT both as a 2 per cent. dust and a 0.1 per cent. spray was superior to 50 per cent. lead arsenate dust while the spray treatments of DDT were slightly better than the dust application.

A similar experiment was carried out during the 1953-54 season to compare aldrin and dieldrin with DDT. Although

detailed results are not available, the indications are that DDT was superior to both of these insecticides.

## RECOMMENDATIONS

From the results of the experiment it is considered that four applications of a 0.1 per cent. DDT spray should give a good control of leaf miners and other chewing insects. These applications should be spaced evenly over the tobacco growing season with the first spray applied approximately one week after planting out. The amount of spray used should vary between 16 to 48 gallons per acre depending on the size and development of the plants.

As an alternative treatment between 10 and 30 lb. per acre of a 2 per cent. DDT dust (four applications) may be used.

Sprays can be applied with a knapsack spray although a low-volume boom spray may be used while the plants are small. Powders are best applied with some type of mechanical duster.

A tobacco leaf badly damaged by leaf miner

**Grasshoppers.**

Several species of grasshopper have been found eating tobacco crops in Western Australia. In trials it has been found that these can be controlled by spraying (to a depth of about a chain) the grassland or bush adjacent to the crop with a 0.1 per cent. dieldrin spray. If grasshoppers are found to be already in the crop 0.1 per cent. dieldrin sprayed on the butts of the plants will give effective control.

**Wireworms.**

No tests for the control of wireworms have yet been carried out in Western Australia but new insecticides have been used with promising results in other tobacco-growing areas and it is hoped that trials with these materials will be carried out in the near future.

## ACKNOWLEDGMENTS

The work here reported has been carried out under the direction of the Government Entomologist (Mr. C. F. H. Jenkins), for which acknowledgment is given. Thanks are due to the officers of the Tobacco Branch for their help and co-operation during trials and experiments at Manjimup.

Fig. 1.—Two popular barley varieties. That on the left is Atlas, a six-row variety. On the right is the two-row Prior, the most popular malting barley in Australia.

# OATS AND BARLEY IN WESTERN AUSTRALIA

By J. T. REEVES, B.Sc. (Agric.), Plant Geneticist

**OVER the five seasons 1948/49 to 1952/53, the latest for which figures are available, the acreages sown to oats and barley in Western Australia, have considerably expanded. Steady progress in clearing and land settlement and reasonably good export prices have been important factors in these increases.**

The relative importance of the three cereals, wheat, oats and barley is illustrated by the following table which shows the total acreages sown to each.

Table 1.
CEREAL PLANTINGS IN ACRES.

| Year. | Wheat. | Oats. | Barley. | Total. |
|---|---|---|---|---|
| 1948–49 | 2,961,409 | 977,811 | 78,087 | 4,017,307 |
| 1949–50 | 2,984,379 | 1,102,640 | 84,845 | 4,171,864 |
| 1950–51 | 3,254,447 | 1,104,998 | 77,673 | 4,437,118 |
| 1951–52 | 3,162,534 | 1,236,313 | 77,346 | 4,476,193 |
| 1952–53 | 3,075,607 | 1,430,699 | 127,916 | 4,633,222 |

## USES FOR OATS

Oats are sown for grain, for grazing and for hay. The proportions sown to each for the five seasons commencing with 1948/49 has remained almost constant, averaging 54 per cent., 37 per cent., and 9 per cent. respectively.

### (a) Sown for Grain.

Whereas nearly all the wheat harvested is used for human consumption, approximately 80 per cent. of the oat grain is now being utilized within the State for stock feed.

The grain is a concentrate, particularly suitable for supplementing the poor, dry grazing obtained from pastures in late summer and autumn. Its protein content is higher than cereal hay or dry pasture and it is therefore a valuable supplement to the dry grazing as it assists in overcoming the protein deficiency which is such a

serious limiting factor in sheep husbandry during the critical months of late summer, autumn and early winter.

**(b) Sown for Grazing.**

When used for grazing, oats provide a bulk of green feed earlier than the natural pastures. Their utilisation in this way permits the pastures to become strongly established with a good body of feed before being grazed off. Oats may be grazed outright or left to recover for grain after moderate grazing but for satisfactory grain yields, stock should be removed just prior to the plants running up into ear as this change from the grassy to the reproductive stage is a critical one.

Oats are a suitable cover crop for the establishment of pastures, particularly clover-ley pastures and provide useful feed while the clover is becoming established. They are very valuable for "scratching in" on dominant clover pastures to produce a balanced grazing and so prevent the development of "clover disease" in sheep.

**(c) Sown for Hay.**

When cut at the early "dough" stage of grain formation, oaten hay is a nutritious fodder. Fortunately cutting at the early "dough" stage corresponds with the times of maximum total yield of hay and maximum yields of total digestible nutrients.

## OAT VARIETIES

The area sown to oat varieties for all purposes, for the previous five seasons was as follows:—

The three leading varieties Ballidu, Dale and Wongan are selections from the same cross—Mulga x Burts Early—and were produced at the Wongan Hills Research Station. They are suitable for grain and hay and also for early green grazing and recovery. Their different maturities cover the range of the planting season in this State.

## OAT VARIETY TRIALS

Oat variety trials are carried out at research stations to determine the most suitable varieties for planting under a wide range of soil and climatic conditions. In addition to named varieties now in cultivation, six new crossbreds, developed at Wongan Hills, have also been under test. The results from last season's trials and where available the average yields for the last four seasons (expressed as percentages) are given in Table 3.

The early planted trials with midseason and late maturing varieties were randomised to enable the results to be statistically analysed. The differences necessary for significance at the five per cent. level (i.e. with odds of 19 to 1) are included in the table. The late planted trial with early varieties was not randomised and therefore could not be analysed.

The following are short descriptions of the varieties under trial:—

**Wogan:** Very early maturing. Its vigorous early growth provides early winter grazing at a time when pastures have not yet grown sufficiently to give bulk of feed. This variety has a tendency to shed its

TABLE 2.—ACREAGES SOWN TO OAT VARIETIES FOR ALL PURPOSES.

| Variety. | 1948–49. | | 1949–50. | | 1950–51. | | 1951–52. | | 1952–53. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Acres. | | Acres. | | Acres. | | Acres. | | Acres. | |
| Ballidu .... .... | 332,540 | 1 | 504,006 | 1 | 586,020 | 1 | 718,644 | 1 | 893,066 | 1 |
| Wongan .... .... | 155,468 | 2 | 169,264 | 2 | 161,507 | 2 | 175,993 | 2 | 177,013 | 2 |
| Dale .... .... .... | 28,155 | 7 | 44,354 | 7 | 56,509 | 5 | 82,304 | 3 | 105,786 | 3 |
| Algerian .... .... | 126,648 | 3 | 108,524 | 3 | 85,793 | 3 | 77,902 | 4 | 66,881 | 4 |
| Fulghum .... .... | 103,662 | 4 | 84,654 | 4 | 68,360 | 4 | 55,495 | 5 | 59,857 | 5 |
| Guyra .... .... | 89,154 | 5 | 76,079 | 5 | 55,848 | 6 | 47,414 | 6 | 47,401 | 6 |
| Mulga .... .... | 68,460 | 6 | 54,299 | 6 | 42,831 | 7 | 37,474 | 7 | 34,711 | 7 |
| Burts early .... .... | 26,213 | 9 | 22,603 | 8 | 15,266 | 8 | 14,846 | 8 | 10,261 | 8 |
| Other .... .... | 47,511 | .... | 38,857 | .... | 32,864 | .... | 26,241 | .... | 35,723 | .... |
| Totals .... .... | 977,811 | .... | 1,102,640 | .... | 1,104,998 | .... | 1,236,313 | .... | 1,430,699 | .... |

TABLE 3.—OAT VARIETY TRIALS AT RESEARCH STATIONS 1953/54 SEASON.

| Variety. | Avondale. | | | Chapman. | | | Merredin. | | | Salmon Gums. | | | Wongan Hills. | | | Esperance Plains. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Yield. | Percent. of Control. | | Yield. | Percent. of Control. | | Yield. | Percent. of Control. | | Yield. | Percent. of Control. | | Yield. | Percent. of Control. | | Yield. | Percent. of Control. | |
| | | 1953. | Average. | | 1953. | Average. | | 1953. | Average. | | 1953. | Average. | | 1953. | Average. | | 1953. | Average. |
| | Bus. | % | % | Bus. | % | % | Bus. | % | % | Bus. | % | % | Bus. | % | % | Bus. | % | % |
| *Early Planted Trial.* | | | | | | | | | | | | | | | | | | |
| Dale .... | 36·0 | 100 | .... | 29·9 | 100 | .... | 24·2 | 100 | .... | 34·3 | 100 | 100 | 39·0 | 100 | .... | 23·3 | 100 | 100 |
| W. 27 .... | 46·1 | 128 | .... | 31·2 | 104 | .... | 25·0 | 103 | .... | 31·8 | 92 | .... | 38·2 | 98 | .... | .... | .... | .... |
| W. 28 .... | 48·2 | 134 | .... | 28·1 | 94 | .... | 21·2 | 88 | .... | 36·4 | 106 | .... | 39·9 | 102 | .... | .... | .... | .... |
| W. 29 .... | 52·5 | 146 | .... | 33·1 | 111 | .... | 29·7 | 123 | .... | 37·8 | 110 | .... | 50·2 | 129 | .... | .... | .... | .... |
| W. 31 .... | 42·0 | 117 | .... | 31·6 | 106 | .... | 28·0 | 116 | .... | 31·4 | 91 | (2) 96 | 44·0 | 113 | .... | 26·5 | 114 | (2) 116 |
| W. 32 .... | 40·7 | 113 | .... | 24·6 | 82 | .... | 19·0 | 79 | .... | 27·8 | 81 | .... | 27·6 | 71 | .... | 25·9 | 111 | .... |
| Algerian .... | 31·8 | 88 | .... | .... | .... | .... | .... | .... | .... | 33·7 | 98 | (2) 104 | 34·0 | 87 | .... | 21·9 | 94 | (2) 101 |
| Acacia .... | 29·5 | 82 | .... | .... | .... | .... | .... | .... | .... | 26·3 | 77 | .... | 31·6 | 81 | .... | 20·4 | 88 | .... |
| Diff. for Sig. P = ·05 | 4·0 | 11 | .... | 4·4 | 15 | .... | 4·2 | 18 | .... | 3·7 | 11 | .... | 2·2 | 6 | .... | 1·2 | 5 | .... |
| *Late Planted Trial.* | | | | | | | | | | | | | | | | | | |
| Ballidu .... | .... | .... | .... | 11·5 | 100 | 100 | 14·7 | 100 | 100 | 27·0 | 100 | 100 | 37·3 | 100 | 100 | .... | .... | .... |
| Orient .... | .... | .... | .... | 18·6 | 162 | (2) 131 | 17·3 | 118 | (4) 116 | 30·6 | 113 | (3) 121 | 42·6 | 114 | (3) 108 | .... | .... | .... |
| W. 30 .... | .... | .... | .... | 14·2 | 123 | (2) 106 | 16·3 | 111 | (2) 112 | 26·8 | 99 | (2) 109 | 36·7 | 98 | .... | .... | .... | .... |
| Wongan .... | .... | .... | .... | 5·0 | 43 | (2) 78 | 10·4 | 71 | (4) 79 | 29·0 | 107 | (3) 99 | 24·4 | 65 | (3) 79 | .... | .... | .... |
| Not randomised .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |

N.B.—Figures in parentheses indicate the number of years under trial.

grain on maturity and early harvesting is essential. This, in part, explains its low yields as compared with Ballidu and Orient.

**Ballidu:** The standard early maturing variety, for both grain and green yields. It has proved its suitability for growing under a wide range of soil and climatic conditions. Straw strength and grain holding ability are two satisfactory characteristics of this variety.

**Orient:** An early maturing variety developed in Victoria from the cross Palestine x Dawn. The grain yields have been consistently better than those of Ballidu at all research stations. In addition it is satisfactory for grazing and recovery for grain. The grain is dark and somewhat unattractive in appearance.

**Dale:** It is similar to Ballidu in all respects except for its maturity, which is midseason.

**Algerian:** A late maturing general purpose oat, Algerian is suitable for wheat and sheep areas with good rainfall.

**Acacia:** This variety, bred by the N.S.W. Department of Agriculture from the multiple crosses (Victoria x Richland) x Algerian x Fulghum is very late in maturity. Its low yield on all research stations is due to its lateness and in consequence it is unsuitable for the wheatbelt.

**New Crossbreds:** Six crossbreds W.27 to W.32 inclusive, have been undergoing trials over the last two seasons. Four of these, W.27 to W.30 are awnless selections from a cross between Ballidu and M.59, the latter being derived originally from a cross between Mulga and Laggan.

Last season in the midseason group, W.29 outyielded Dale, the control variety, at Avondale, Merredin and Wongan Hills. This crossbred holds its grain well and has short, stiff straw. Because of its yielding ability and good agronomic characteristics it is anticipated that it will be released for general cultivation at the end of the 1954/55 season. As W.27 and W.28 are both lower yielding than W.29, they have now been discarded. W.30 an early maturing selection is intermediate in yield between Ballidu and Orient. It is being retested this season.

The other two crossbreds W.31 and W.32 are selections from a cross between Ballidu and Fulghum. Grazing trials have indicated they possess the grazing capacity of Fulghum, but hold their grain better and are stouter strawed. W.32 has been discarded as W.31 has given the higher yields. The latter is being retested in further trials.

Fig. 2.—Ballidu oats. This is the most-widely-grown variety in Western Australia, and is an excellent general-purpose cereal suitable for grazing, hay and grain.

The recommended varieties for each of the three major zones of the wheatbelt are listed in the following table: —

TABLE 4.—RECOMMENDED OAT VARIETIES.

| Maturity Group. | ZONE 1 (Early). Less than 14 inch Annual Rainfall. | ZONE 2 (Midseason). 14 inch to 18 inch Annual Rainfall. | ZONE 3 (Late). Over 18 inch Annual Rainfall. |
|---|---|---|---|
| Midseason and late | Dale | Dale<br>Algerian | Dale<br>Algerian |
| Early .... | Ballidu<br>Orient | Ballidu<br>Orient | Ballidu<br>Orient |
| Very Early .... | Wongan | Wongan | Wongan |

## BARLEY IN WESTERN AUSTRALIA

The area sown to 6-row barley increased rapidly in the last season under review (1952/53). This, in part, was due to satisfactory export prices. Very little 6-row barley is used for malting in this State and the grain is either exported or used locally for stock feed. Grazing trials have shown that 6-row barley, particularly the variety Atlas is suitable for this purpose. In addition recovery for grain yields compare favourably with oat varieties.

The 2-row barleys are grown for the local malting trade, but production in recent years has been below requirements. A plump starchy grain with a minimum of skinning and harvesting damage is most favoured for malting purposes.

The following table lists the more important varieties and the acreages sown to each over the five year period ending with the 1952/53 season.

TABLE 5.—ACREAGES SOWN TO BARLEY VARIETIES FOR ALL PURPOSES.

| Variety. | 1948–49. | 1949–50. | 1950–51. | 1951–52. | 1952–53. |
|---|---|---|---|---|---|
| *6-row.* | | | | | |
| Atlas .... | 31,485 | 35,382 | 37,336 | 40,945 | 80,988 |
| Cape .... | 11,296 | 9,027 | 7,798 | 9,862 | 12,761 |
| Californ-ian .... | .... | 4,056 | 2,958 | 3,812 | 5,267 |
| Others.... | 1,671 | 2,811 | 3,749 | 4,113 | 3,674 |
| Total 6-row | 44,452 | 51,276 | 51,841 | 58,732 | 102,690 |
| *2-row.* | | | | | |
| Prior .... | 31,806 | 30,452 | 23,101 | 16,027 | 21,297 |
| Malt-worthy | 664 | 554 | 509 | 1,265 | 2,812 |
| Others.... | 1,165 | 2,563 | 2,222 | 1,322 | 1,117 |
| Total 2-row | 33,635 | 33,569 | 25,832 | 18,614 | 25,226 |
| TOTALS | 78,087 | 84,845 | 77,673 | 77,346 | 127,916 |

## BARLEY VARIETY TRIALS

Barley variety trials are carried out at Avondale, as this is considered the most suitable station for testing.

The yields for last season and the average yields, expressed as percentages for previous years are set out in the following table:—

TABLE 6.—BARLEY VARIETY TRIAL, 1953/54 SEASON.

| Variety. | Type. | Grain Yield. | Percent of Control. | |
|---|---|---|---|---|
| | | | 1953. | Average. |
| | | Bushells per acre. | | |
| Prior .... .... | 2-row | 25·4 | 100 | 100 |
| Maltworthy .... | 2-row | 26·3 | 104 | (10) 123 |
| Freja .... .... | 2-row | 27·1 | 107 | (2) 136 |
| Kenia .... .... | 2-row | 24·6 | 97 | .... |
| Atlas .... .... | 6-row | 21·9 | 86 | (10) 121 |
| Diff. for Significance P = ·05 .... | .... | 3·1 | 12% | .... |

Figures in parentheses indicate the number of years under trial.

## DESCRIPTION OF BARLEY VARIETIES

**Prior:** This is the most popular malting barley in Australia. At Avondale it has been consistently outyielded by Maltworthy.

**Maltworthy:** Slightly later maturing than Prior and requiring longer growing conditions to produce malting grain of good quality.

**Freja:** A short, strong strawed Swedish variety. In two years trials at Avondale, yields have been very satisfactory.

**Kenia:** Bred in Denmark, this variety also possesses short, stiff straw. Although only tested for one year at Avondale, it appears to be lower yielding than Freja.

**Atlas:** The standard 6-row variety. It is suitable for early green feed, for feed grain and for export. Last season its yields were low at Avondale but the results for 10 years trials on this station show that it normally outyields Prior.

The recommended varieties and the purposes for which they should be grown in each zone, are set out in the following table:—

TABLE 7.—RECOMMENDED BARLEY VARIETIES.

| Use. | ZONE 1 (Early). Less than 14 inch Annual Rainfall. | ZONE 2 (Midseason). 14 inch to 18 inch Annual Rainfall. | ZONE 3 (Late). Over 18 inch Annual Rainfall. |
|---|---|---|---|
| For Malting— | | | |
| Local trade | .... | Prior *Maltworthy Atlas | Prior Maltworthy Atlas |
| Export trade | .... | | |
| For fodder grazing and grain .... | Atlas | Atlas | Atlas |

* Higher rainfall areas of this zone.

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# LICE ON CATTLE

**SIX different species of cattle lice occur in Australia including both sucking and biting types. Both types produce symptoms of skin irritation but the sucking lice are the more serious since they feed in clusters, piercing the skin and sucking up blood and tissue foods, whereas the biting lice feed only on scurf and scales on the surface of the skin. Heavy lice infestations cause acute irritation and the cattle are constantly rubbing against fences and trees to allay the discomfort. The presence of lice in large numbers causes retarded growth and loss of condition.**

The lice lay their eggs close to the skin of the animal, where they are found glued to the hair. These eggs hatch in 8 to 13 days, giving rise to a new generation of lice which commence to produce eggs in from 13 to 17 days so that the complete life-cycle from egg to egg occupies only 21 to 30 days.

The most common species found in the South-West of Western Australia is the long-nosed sucking louse (*Linognathus vituli*) which often infests young cattle in great numbers during winter and spring. These parasites attain a length of about one-tenth of an inch, and are dark bluish in colour. The head is long and narrow, being twice as long as its width. When associated with worm infestation and inadequate nutrition these lice may contribute to the unthriftiness and mortality which is often reported among calves and young cattle during the winter months.

For the control of lice in cattle, dipping or spraying with 0.5% DDT or 0.5% gamma isomer B.H.C. (gammexane) may be recommended. Suspensions of the desired concentration may be prepared from proprietary preparations available on the market, or in the case of B.H.C., any of the gammexane sheep dips at four times the strength recommended for sheep may be used. Due to the fact that these substances remain deadly to lice for a long period after application, a single treatment will usually effect complete eradication by destroying young lice which may subsequently hatch from the eggs. If it is desired to make doubly sure, a second treatment after an interval of 14 days is advisable.—C.R.T.


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# ALTERNATIVES TO BRAN AND POLLARD

By L. C. SNOOK, D.Sc., Animal Nutrition Officer

**BRAN and pollard are excellent foodstuffs for inclusion in the rations fed to dairy cows. There is no justification however, for the assumption that these mill offals are essential for efficient milk production. For many years bran was readily obtainable and comparatively cheap; rightly, it was then accepted as the best supplement to use under a variety of conditions. However, there is no need for concern now that both bran and pollard are difficult to buy and costly in comparison with cereal grains.**

Dairy farmers have displayed a surprising reluctance to make use of cheap cereal grains as they have become available. For example, milk producers continued to compete for bran even when oat grain could be purchased for 7s. per bushel or £17 10s. per short ton. Feed barley, an excellent concentrate for cattle and pigs was available at 9s. 6d. per bushel or £19 per short ton. Despite this, dairy farmers' organisations were complaining that the shortage of mill offal was reducing the efficiency of the industry. Obviously this belief arose because bran, in particular, was considered to be an irreplaceable necessity.

## WHAT CONCENTRATES SHOULD CONTAIN

It is important to appreciate what the dairy cow requires in its concentrate ration. At the present time young green pasture is available to most herds. This young greenstuff is rich in digestible protein, minerals and vitamins, but the high water content limits the amount of pasture which cows can eat. Generally, meadow hay is fed to counter the effects of the slushy green feed. Hay also is a bulky food and if fed to excess can limit production. Under such conditions the ideal supplement for high producing dairy cows is an easily digested palatable concentrate rich in energy. Cereal grains fulfil these requirements to perfection and farmers should be made to realise the importance of studying comparative costs so that the cheapest supplement can be used. As can be seen from the accompanying table, at present mill offals are relatively expensive foods.

## CEREAL GRAINS

There is a definite prejudice, almost a fear, which prevents many farmers from using cereal grains. Perhaps the most outstanding characteristic of bran is its bulkiness. This bulkiness makes bran a "safe" food. It is well-nigh impossible for a cow to eat enough bran to do it any harm. With cereal grains, particularly wheat, some care is required, because digestive upsets can follow careless feeding methods. It should be stressed, therefore, that wheat and barley can be used with confidence so long as reasonable care is taken. About 20 years ago the Jersey herd of S. P. Herbert at Nungarin attracted considerable attention because of the high yields obtained with home-grown foodstuffs in the 14 inch rainfall. Cereal grains were the only concentrates used and I have seen as much as 8 lb. of crushed wheat fed each day to small cows during the dry summer months. These cows held their own with the best studs in the South-West and demonstrated to me the value of cereal grains as a concentrate for productive animals. This is an extreme example, of course, and it is not suggested that heavy feeding of any one cereal should be practised. There are advantages in feeding mixed supplements and the present objective is to encourage dairy farmers to use some grain at least. If half the mill offal at present being used was replaced by cereal grain, the present acute shortage would be eased considerably.

## RESULTS AT BRAMLEY

In this connection it is of interest to consider results obtained at the Bramley Research Station with ordinary grade cows. Last season, as four-year-olds, the group receiving a phosphatic supplement averaged 304 lb. butterfat and have averaged five gallons of four per cent. milk over the first five weeks of the current lactation. The concentrate ration consists of a mixture of two parts crushed wheat and one part pollard, fed at the rate of 3 lb. per head daily. The mixed green pasture available to these cows is no better than that which should be present on most South-West farms and the only other provision is the usual ration of meadow hay. Production such as this does not suggest that bran or any of the costly special dairy foods is necessary for continued high production. No doubt the pollard could be replaced with oats or barley, or even additional wheat, without any fall in production and if pollard remains in short supply, this substitution will be made.

As a guide to the cost of concentrates the following details are given. Grain can be obtained from the Bunbury silos at the following prices:—

Wheat—14s. 3d. bushel of 60 lb.

Feed Barley—9s. 3d. bushel of 50 lb.

Six-ton loads of this grain are being delivered into farmers' bins at Margaret River for a cartage charge of £12 per load. Thus a mixture of equal parts of wheat and feed barley is being landed on these farms at a total cost of £22 2s. 6d. per short ton. There should be no cause to worry about the cost or scarcity of mill offal when such an ideal food for cattle, pigs or poultry can be obtained so economically. Admittedly, the grain has to be crushed, but most farmers have the equipment to do this. Of course, not all farmers can store bulk wheat, but it would pay "small men" to co-operate and bag the bulk wheat on arrival for distribution as required. Careful consideration should be given to the saving in money this bulk buying can achieve. Incidentally, it should be remembered that cereal grains should not be finely ground when they are fed to dairy cows. The grain should only be rolled or broken and NOT reduced to a flour.

**To summarise.**—Bran and pollard can be replaced by crushed cereal grains without loss in production and at a considerable saving in cost.

A table has been prepared from which the farmer can calculate the comparative value of the alternative concentrates available.

### CEREAL GRAINS AND MILL OFFAL
### Comparative Prices and Food Values

| | Price. | | Energy Value. | Protein Content.* |
|---|---|---|---|---|
| | Per bushel. | Per 2,000 lb. | | |
| | s. d. | £ | | |
| Bran .... .... | 4 3 | 24 | 60 | 14 |
| Pollard .... .... | 4 3 | 24 | 75 | 13 |
| Wheat .... .... | 14 3 | 23–15 | 72 | 10 |
| Oats .... .... | 8 0 | 20 | 60 | 10 |
| Feed Barley .... | 10 0 | 20 | 70 | 10 |

* These are average values. The protein content of the same variety of cereal grain can vary from 8 per cent. when grown in the Avon Valley, to 15 per cent. in the Eastern Wheatbelt. Mill offal will also vary according to the origin of the grain.

# POT PLANTS

## FOR INTEREST *and* ENJOYMENT

By C. C. Hillary

Lantanas are suitable for both pots and hanging baskets. The specimen shown here is Lantana sellowiana

**POT plants provide a wealth of interest and give considerable pleasure to all those who enjoy having beautiful things around them. When the plants are carefully selected, there are nearly always some flowers available for the home, and the foliage types readily lend themselves to many kinds of indoor decoration.**

The cultivation of plants in pots or other containers is not at all difficult. Commonsense is the main requirement. The others are a suitable potting soil and sufficient water to keep the pots moist. This requires little more than a gallon or two of water a day, unless the collection is a large one, and it is this fact that makes pot plants of so much value to those living in dry areas where ordinary gardening is often impossible, except, perhaps, for a brief period in winter.

A beautiful pot plant may be one that flowers, or a type grown for its foliage alone, but whatever it is, it should be a plant that makes a pleasing head of growth somewhat wider than the width of the container. This calls for a plant with a spreading habit of growth and there are many species suitable for the purpose. The additional requirement, when a plant such as a conifer is used, is that it should have even, symmetrical growth of good proportions.

### COLOURFUL BLOOMS

When making up a collection of pot plants, it is always wise to devote a proportion of the pots to plants that are known to flower well. There will then be plenty of colour to blend with the various greens of the foliage plants. While it is desirable that most of the plants grown in containers should be perennials, or long-lived plants, the value of annuals should not be overlooked. A few grown each winter and summer would add a wealth of colour to any collection.

The Schizanthus, or poor man's orchid, is one of the best annuals. With its hundreds of floral bells in many lovely colours, it makes a splendid pot plant for several months of each year. The golden

and crimson-coloured Celosias are also magnificent in pots and both are easy to grow. Then there are Godetias, especially the variety Sybil Sherwood; Clarkias, Portulacca, Pansies, Aquilegias, Anemones, Cineraria, Gilia, Lobelia, Nasturtium, Salvia (both red and blue), and Salpiglossis, all of which can be relied upon to give a good account of themselves when grown in suitable containers. In addition to the ordinary annual flowers, the value of bulbous flowers for pot work, such as the Hyacinth, Daffodil and Lachenalia, should not be overlooked.

### SHRUBS ARE LONG-LASTING

For pot plants of more permanent character there are numerous kinds of shrubs, and other plants of perennial and herbaceous habit. Then there are the various kinds of maiden-hair fern (Adiantum), Fish Fern (Nephrolepis) and palms such as the Kentia and Phoenix Roebelenii.

Shrubs which readily lend themselves for growing in pots include Rhododendrons, Azaleas, Daphnes, Hydrangeas, Fuchsias, Veronicas, Diosmas, Phyllanthus, Choisya ternata (Mexican Orange Blossom), Erica, Acalypha, Gardenia, Genista, Hibiscus Cooperii, Lantana Sellowiana, Plumbago, Punica nana (dwarf pomegranate), Rondeletia, and the Cumquat. The last-named makes a really splendid ornamental for a porch or sunny verandah when grown in a half-barrel. Other suitable plants include the various varieties of Pelargonium, Geraniums, Gerbera, Acanthus, Agapanthus and Agathea.

### CONTAINERS

The type of container makes a great deal of difference to the amount of care that a plant requires. Small pots tend to dry out more quickly than large ones and need more frequent watering. On the other hand, if a tiny plant is placed in a very large container, there is always a chance that the soil will become what is known as "soured" before the roots grow large enough to make full use of it.

Terra-cotta clay pots are suitable for most plants and they always look attractive when kept thoroughly cleaned. To keep them clean, they should be brushed regularly with a stiff brush soaked in soapy water. Kerosene tins and old oil drums

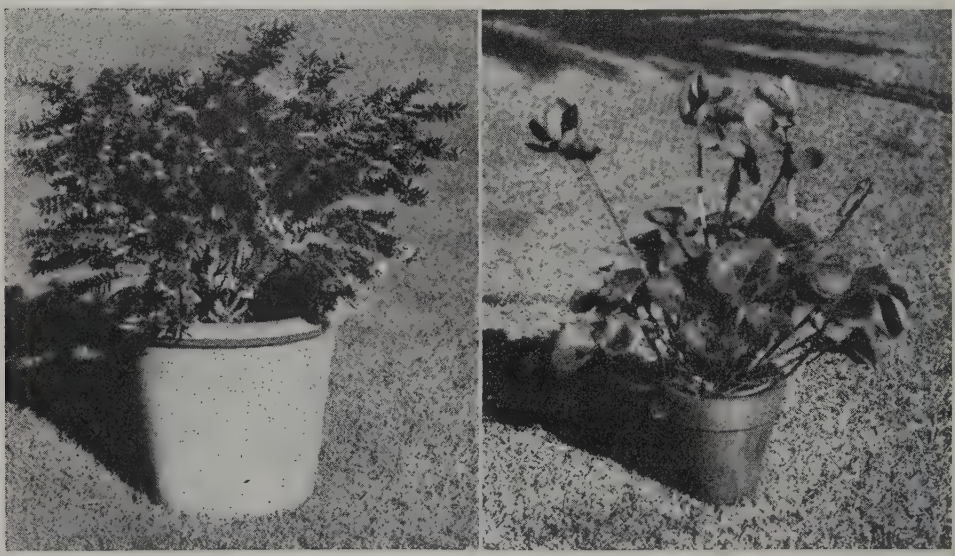

Fig. 1.—The plant on the left is the well-known Veronica, Blue Gem. There are several varieties of Veronica with blue and pink flowers which, with their attractive foliage, make them suitable subjects for potting. On the right is a Cyclamen. It's rich colour and variegated leaves make it an attractive exhibit

make good containers for large plants, but they usually look unsightly unless painted on the outside. They also last longer when given a coat of cement wash on the inside before being used. But the finest large containers are the half-barrels made of polished sheoak, with painted bands around the outside. These can be bought at most nursery stores at moderate cost. They last for years and have a handsome appearance. I know of nothing more suitable for a Cumquat or a large Azalea.

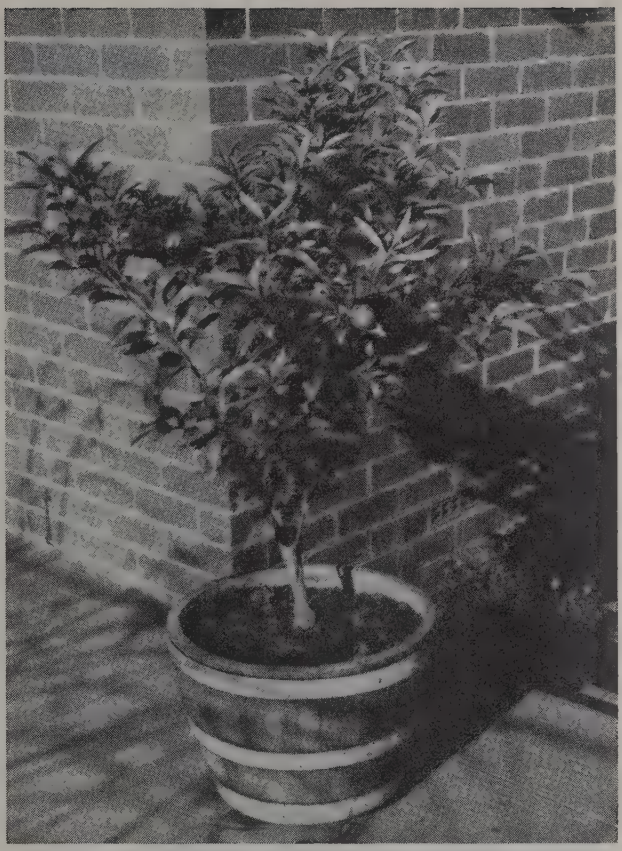

Fig. 2.—The Cumquat, a specimen of the Nagami variety of which is shown here, has dark green, almost polished, foliage and bright orange fruits. Grown in a tub it makes a colourful verandah ornament

**DRAINAGE IS IMPORTANT**

All pots and containers must be adequately drained, since quick and efficient drainage is essential to the health of all plants. Most clay pots are provided with holes of sufficient size in the bottom, but tins, drums, and half-barrels should have not less than five half-inch holes pierced or drilled in various parts of the bottom.

Plenty of drainage material in the shape of crocks, broken tiles or small stones should be placed over the holes and over this should be placed a layer of decayed leafy matter or half-rotted straw. This material is to prevent the soil from washing down into the crocks and interfering with the drainage. The pots are then ready to receive the soil mixture.

**PREPARING THE SOIL**

It is essential that a good soil mixture should be prepared since it has to last a long time and it is advisable to make it up some weeks beforehand so that it may be nicely mellowed before being placed in the containers. Some good surface loam from an old pasture, sand, well-rotted cow or horse manure and well-decayed leafy compost are the ingredients required and these should be mixed together as follows: five parts loam, one part of sand, two parts old manure, one part of leafy compost. To every barrowload of this mixture should be added a four-inch potful of blood and bone manure. The loam and other ingredients should be spread out over a cement drive or similar place and shovelled back and forth until everything is thoroughly well blended.

This soil will be found suitable for all ferns, shrubs and perennial plants, but when used for annuals, it is usually advisable to add a little less than a half-part of air-slaked lime. It is most important, however, that lime **should not** be included in any soil mixture used for Camellias, Azaleas, Rhododendrons and Daphnes. These plants abhor lime in any form and

for this reason wood ashes should not be placed in the bottom of the containers for drainage purposes.

## POTTING HINTS

Actual potting is work you learn with practice. The more you pot the greater your skill. All potting should be done fairly firmly and care taken to see that the soil is firmed at the side of the pot as well as close in to the plant. Evergreen plants should be repotted without disturbing the soil ball around the roots and all plants should be potted at much the same depth as they stood when growing in a previous pot or in the nursery.

Fig. 3.—This attractive dwarf conifer, Thuja occidentalis, is of the book-leaf type and its golden foliage makes it a popular and pleasing subject for potting

During the planting, the soil should be filled in around the plants until within about an inch of the top with small pots and to within two inches of the top with large containers. These spaces are to allow sufficient room for watering. To make sure that the soil is firmed sufficiently around the sides of the pots, it is advisable to tamp it down, as filling proceeds, with a blunt-ended stick. Soil used for potting should be just moist and no more. If a ball of soil taken in the hand crumbles when pressed, the moisture content should be about right.

## WATERING AND FEEDING

Watering is important. Pot plants can enjoy only what is given them and no more. They cannot stretch thirsty roots into new areas in search of moisture. Overwatering must also be avoided. Watch your plants carefully and water as often as is necessary to keep the soil moist, but not wet. A simple way of determining whether a pot plant requires water or not is to tap the side of the pot in the middle with a wooden hammer. If the sound made seems hollow or ringing, water is required, but a dull, heavy noise indicates an ample moisture content.

Feeding with liquid manure will also be necessary with most pot plants, because the soil mixture gradually loses its plant food as the result of frequent watering. It should be commenced about a month after potting and then continued at monthly intervals.

Liquid manure suitable for most plants can be made by steeping a quantity of horse, cow, or poultry manure in a tub of water . It will be of suitable strength when its colour resembles that of weak tea. Darker and stronger solutions should be broken down with additional water before being applied. Small plants may be given up to half-a-pint, but large plants will probably enjoy two or three pints. To ensure that no plant will have a "hangover," all plants should be given a drink of fresh water before being fed with liquid manure.

# VITAMIN A SUPPLEMENTS FOR SHEEP

## EXPERIMENT AT THE WONGAN HILLS RESEARCH STATION, 1954

By L. C. SNOOK, D.Sc. (Aberdeen), B.Sc. (Agric.), Animal Nutrition Officer.

**GRAZING animals build up their reserves of Vitamin A from the carotene present in green plants. In the West Australian wheatbelt most stock have to subsist mainly on dry feed during summers which last from five to seven months. It seems unlikely that any appreciable amount of edible greenstuff is available during this "annual drought." It is not surprising, therefore, that stock losses which have occurred in the late summer months have been attributed to lack of Vitamin A.**

The possibility that sheep, in particular, are likely to suffer from this prolonged lack of greenfeed, has been suggested many times. However, as the result of investigations carried out in this State by Underwood and his associates, and by other workers in South Australia, it has been accepted that sheep can conserve sufficient Vitamin A in the liver to supply all requirements for at least 5-6 months.

A trial carried out at Walebing some years ago appeared to confirm this conclusion when breeding ewes on dry feed showed no obvious benefit from dosage with Vitamin A supplements (Underwood, 1953).

However, in November, 1952, the C.S.I.R.O. released a preliminary report on trials carried out in New South Wales. These suggested that Vitamin A supplements could be of considerable value to sheep on dry cereal rations. This report has received considerable publicity and the results have been used to encourage the supply of Vitamin A supplements to breeding ewes and "weaner" lambs. It has become important, therefore, to determine if these supplements are likely to be of value to flocks in Western Australia.

First and foremost, it should be stressed that the investigations of the C.S.I.R.O. confirm the conclusion of earlier workers that breeding ewes carry a considerable reserve of Vitamin A in their livers. The experimental ewes were able to rear normal healthy lambs although kept for a full year on a Vitamin A-deficient ration of cereal chaff and cereal grain.

It was only when the ewes were mated a second time that the reserves of Vitamin A became so depleted that many of the second crop of lambs were born dead or died soon after death. Fortunately, flocks in the West Australian wheatbelt are never required to go without green food for as long as twelve months.

When weaner lambs in New South Wales were kept for seven months on cereal hay and cereal grain, heavy losses occurred among those not receiving a Vitamin A supplement. But here again it will be noted that the need for Vitamin A became apparent only after many months on a deficient diet. Thus during the first four months on dry feed 13 of the weaners receiving the supplement died (there were 125 animals in the group). There were 20 deaths among the controls. As the experiment continued, however, the losses became severe among the controls and one must conclude that Vitamin A supplements may become essential where weaners are forced to subsist on dry feed for four months or longer.

### LOCAL EXPERIMENTS

In order to obtain further information concerning the possible value of Vitamin A supplements under local conditions an experiment is now under way at the Wongan Hills Research Station. This is similar in design to the trial carried out by the C.S.I.R.O. At Wongan Hills no green feed has been available since late October so the experimental animals have already subsisted on a Vitamin A-deficient diet for six months.

**Breeding Ewes.**—Two hundred Merino ewes are being used in the trial. These were run through a race on February 18 and every second animal received a dose of high potency shark oil containing 500,000 Int. Units of Vitamin A. The ewes all carry numbered ear tags and ran together as one flock until lambing commenced. If the supplement is of any value this should be reflected in the number and/or quality of the lambs at marking time.

Healthy lambs are now being born in both groups and it is still too early to judge whether the supplement has produced any effect.

**Weaners.**—50 Merino x Border Leicester wethers are being used in this trial. As was the case with the ewes, the weaners were run through a race on February 18 and each alternate one received 500,000 Int. Units of Vitamin A. The experimental animals carry ear tags and are weighed every three weeks. The sheep are handfed three times a week on chaffed cereal hay and oat grain at the rate of 2 lb. of chaff and 1 lb. of grain per head daily. Very little roughage is available in the paddock.

To date no significant difference can be seen between the treated and untreated wethers. On February 22 and 25 controls averaged 81.9 lb. in liveweight (range 59-98 lb.) while the supplemented group averaged 82.5 lb. (range 68-98 lb.). On April 29 the respective averages were 84.7 lb. and 86.6 lb.

## FUTURE WORK

It is anticipated that detailed work over a period of years will be necessary in order to obtain authoritative information on the value of Vitamin A supplements in various parts of this State. It may be important to carry out experiments on a number of research stations because the sheep at Wongan Hills, for example, may have access to some insignificant but all-important source of Vitamin A. A hardy perennial weed which escapes observation or the leaves from assumedly inedible shrubs could possibly supply the small amount of greenstuff needed to tide the animals over the summer months. Obviously many factors will have to be considered in designing future experiments.

**Reference.**

Underwood, E. J. (1953). Proceedings of Conference of Agricultural Scientists, Perth, W.A.

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# TREATING HARD WATER

By L. W. SAMUEL, Ph.D., Deputy Government Agricultural Chemist.

**ON some farms there are ample supplies of water which, although suitable for many domestic purposes, including human consumption, is too "hard" to be satisfactory for washing purposes. Waters are described as "hard" or "soft" depending on the difficulty or ease of obtaining a lather with soap. Not only is it difficult to obtain a lather with soap in a "hard" water but also large quantities of soap curds are formed.**

These "hard" waters also cause deposits or "fur" in kettles and other vessels used for heating water and such deposits may be a common source of trouble in domestic hot-water systems.

Hardness in water is usually due to the presence in the water of calcium and magnesium but may also be caused by acid or by large quantities of common salt in the water. All of these materials cause hardness for the same reason. To obtain a lather with soap it is necessary to have soap in solution. The hardness factors cause the separation of a solid soap, the curd, and so prevent lathering. If sufficient soap is used, all of the calcium, magnesium and acid can be used up in curd formation and then further soap can remain in solution and cause a lather, but it is not possible to overcome in this way the hardness due to common salt.

Although the safe upper limit of soluble salts in water is considered to be 150 grains per gallon for general domestic use and human consumption on individual farms, such water will be very hard. There are available to the farmer various methods of dealing with hard water where the hardness is due to acid, calcium or magnesium. Hardness due to relatively large amounts of common salt cannot however be economically removed on the farm as yet and thus even if the calcium, magnesium and acid hardness are corrected in a salty water, the water will still be hard.

## ACID WATERS

Where hardness is due to acid in the water, the condition may be easily corrected by adding a small quantity of lime. The quantity required will depend on the degree of acidity but rarely exceeds 8 oz. to each 1,000 gals. of water.

## CALCIUM AND MAGNESIUM

There are several methods of treating water containing calcium and magnesium.

1. The hardness may be reduced, though not entirely removed, by simply boiling the water and allowing it to cool.

2. The addition of washing soda will reduce the hardness of water, the quantity of washing soda necessary being dependent on the degree of hardness of the water. The soda has more effect in hot water than in cold water. Care should be taken not to use too much washing soda and a trial could be made using 1 oz. of washing soda per 10 gallons of water and then increasing or decreasing the quantity of washing soda as required. Equal quantities of washing soda and borax mixed can be used instead of washing soda alone.

3. A chemical known as Calgon or Micromet can be added to water to give the same effect as softening. This also works better in hot water than in cold, about twice as much Calgon being required in cold water as in hot water. A trial could be made using 2 ozs. of Calgon per 10 gallons of water. Calgon is available from Imperial Chemical Industries of Aust. & N.Z. Ltd., c/o. Elder, Smith & Co. Ltd., Perth.

4. Soap can be used to soften water in a separate vessel, using the clear water free from soap curds.

5. The use of a soap containing washing soda or other alkaline ingredients or the use of a salt water soap reduces the effects of hard water.

6. Since hardness in water is normally due to salts of calcium and magnesium the water can be softened by removing the calcium and magnesium. This can be done relatively easily by passing the water through a bed of material known as Zeolite or Permutite, when the calcium and magnesium from the water exchange with sodium from the Zeolite. The Zeolite becomes exhausted in time, i.e., can no longer exchange sodium for calcium and magnesium, but the Zeolite can be regenerated by a strong solution of common salt. The sodium from the common salt exchanges with the calcium and magnesium in the Zeolite and so re-forms the original sodium-Zeolite which can then be used to soften more water (after washing out the excess of salt). Unfortunately these softeners are not usually satisfactory for waters containing more than 100 grains per gallon of total salts because (a) the common salt in the water acts in opposition to the softening action (b) the water will still have some hardness due to the salt and (c) such waters are usually very corrosive after softening.

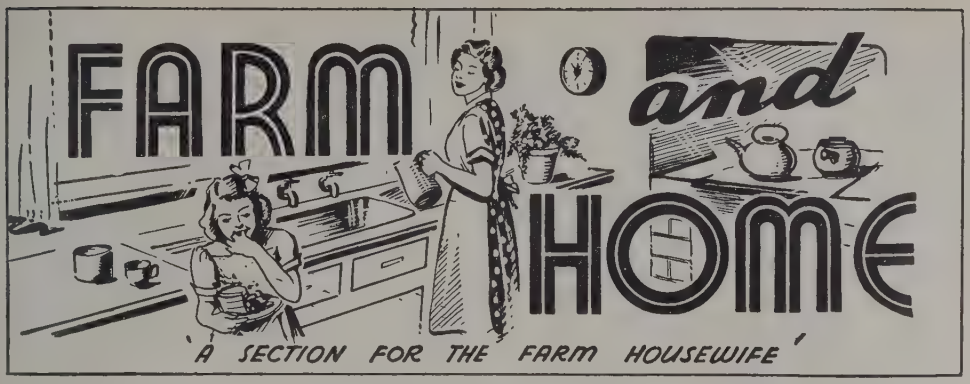
These softeners are available commercially and some of the firms dealing with them are:—R. J. Fletcher, Chemical Manufacturer; The Western Machinery Co. Ltd.; Tomlinson Steel Pty. Ltd.; W. J. Lucas Ltd.; Atkins (W.A.) Ltd.; David Gray & Co. Ltd.; Westralian Farmers Co-operative Ltd. and J. H. Wilberforce & Co.

**Since these softeners work by exchanging sodium for calcium and magnesium they do not reduce the total salt content of the water. In this respect they differ from the newer synthetic resins used for removing all salts from water and which are much more expensive to instal and to regenerate and are as yet uneconomic for farm use.**

7. For laundry work one of the newer detergents, called "soapless soaps," or soapless cleansers could be used. These materials lather in hard water because there is no precipitation of an insoluble "soap" and are extensively used in England and America.

With the exception of pre-boiling (Method I), and passing the water through a bed of proprietary water-softening compound (Method 6) the methods described are not suitable for the treatment of drinking water but are designed to make the water more suitable for laundry and other household uses. For people subject to skin rashes, alkaline soaps are best avoided, but the proprietary salt-water soaps are usually satisfactory.

In applying methods 1, 2, 3 and 4 it is best to use a separate vessel for the treatment, allowing to settle and using the clear liquid free from scum or sediment.




# CAKE ICING FOR THE BEGINNER

By BRENDA CLEEVE, Home Science Teacher, Education Department

**THE icing of a celebration cake need not necessarily be a task for the specialist. With a little patience, perseverence and practice even an inexperienced person can turn out some pleasing results.**

If you are a beginner in the art of cake icing these few simple rules will help to make your task easier; if you are already experienced, a reminder will not go astray.

Firstly be content with simple designs. Many beginners endeavour to hide basic errors by adding an elaborate camouflage which results in over-decoration.

Secondly, the beginner should be content to use white icing and pale pastel colours as these blend easily. Avoid using too many colours on the same cake.

Lastly, pastel backgrounds show up the decoration to advantage. A background that is too dark or too bright detracts from the design.

## THE CAKE BOARD

Some type of firm support is necessary before we commence the task of icing the cake. This may be provided by a piece of thick cardboard, three-ply, masonite or light wood at least 1in. larger all round the cake in order to give balance and make handling easier.

The board should be covered with clean white paper, cellophane, or a paper doyley. Silver or gold paper doylies may be used to highlight a cake and coloured doylies to match, or in contrast to, the colour scheme of the icing are also attractive.

Suitable icing boards may be bought from city stores for a few pence—a 12in. board costs about 1s. 2d. These boards are circular or square in shape and are usually covered with gold or silver paper.

If two strips of wood about 1in. wide and 6in. long are tacked to the bottom of the board so as to raise it off the table, it may be handled much more easily.

Fig. 1.—A cake on the cake board. This cake is covered with a rolled plastic icing and decorated with sprays of flowers and leaves in pastel shades made as shown in Figure 2. The decorations are in plastic icing secured with dabs of royal icing.

## PREPARING THE CAKE

Before commencing the icing operations, decide which side of the cake you wish to ice. If the aim is a perfectly flat base it is usually easier to ice the bottom of the cake as very few cakes rise quite evenly and it is not always easy to cut the top to give a level surface. Should the cake have risen evenly or to a symmetrical peak the top may be utilised as the basis for the design.

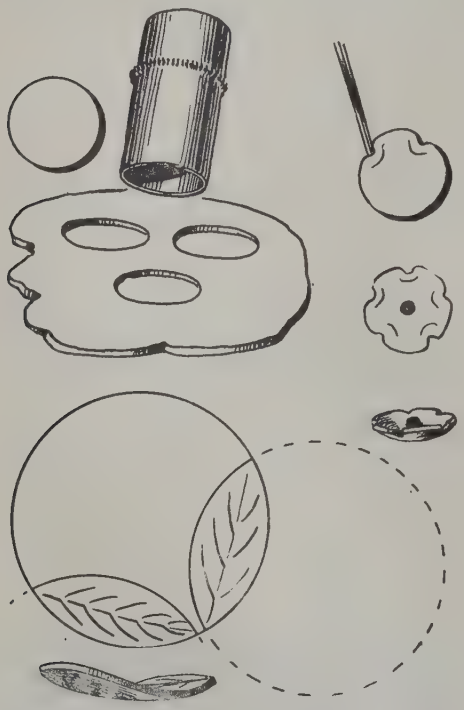


Fig. 2.—Showing method of using a lipstick container, a knitting needle and a small scone cutter to make floral decorations in plastic icing.

Place the cake in the centre of the icing board and check thoroughly to make sure that the top is level before proceeding with the next operation.

## COVERING THE CAKE

The covering can be a rolled plastic icing, or royal icing. Plastic icings give a smoother finish and while they set firmly, they do not harden, and are still edible after being exposed to the air for some time. Royal icing is difficult to apply smoothly as a base and dries very hard. It also tends to absorb grease from the cake and becomes discoloured with the passing of time. Royal icing is therefore better suited to decorative work than for use as the main base.

Before applying the icing, rub a little sifted icing sugar into the surface of the cake to remove any loose crumbs, then brush the cake with a little smooth jam (jam without seeds or lumps). An alternative is to apply beaten egg-white to help the icing to adhere to the surface of the cake.

When the plastic icing is to be used, roll it into a smooth ball. Measure the width in inches across the cake and add twice the depth. The measurements of a cake 8in. across the top and 3in. deep would therefore be 14in. (8in. plus 3in. plus 3in.) For a cake of this size the icing should be rolled out into a circular shape a little less than 14in. in diameter and $\frac{1}{8}$in. to $\frac{1}{4}$in. thick. If you find the icing sticking to the rolling pin or board dust with a little cornflour or arrowroot instead of icing sugar.

The circular piece of icing is rolled out smaller than the cake to allow for stretching when it is applied. If it is rolled any bigger you will find that you have a lot of fullness which is hard to ease out when applying the icing.

Lift the icing carefully on the rolling pin and place it evenly on the cake. By using the rolling pin you are less likely to have holes appearing in the icing sheet which will spoil the smooth finish. Any fullness in the icing may be eased down and pressed out against the sides of the cake. When icing a square cake, the icing is naturally rolled out into a square shape and it will be necessary to cut triangular pieces out of the corners to obtain a neat finish.

The icing should be pressed firmly to the cake, starting from the top to avoid air-bubbles. Any bubbles which do occur should be pricked with a sterile needle.

Should the icing split or tear while being placed in position, moisten the cut edges slightly with water and gently press them together. The same treatment should be

given to the edges where pieces have to be cut out at the corners of a square cake. The joins may then be smoothed over and made invisible.

When the icing is in position the top of the cake can be "polished" by rubbing it gently with the palm of the hand.

If you have decided to ice the bottom of the cake because the top is uneven, don't worry if you have gaps between the edges of the cake and the board. These may be filled in by making a roll of plastic icing and pressing it into the spaces before the top is covered.

Trim off the bottom of the covering icing before it sets too firmly.

## ICING RECIPES

### 1. Plastic Icing (Uncooked).

1 lb. icing sugar.
2 tablespoonfuls glucose.
1 egg white.
1 teaspoonful copha.
Flavouring as required.

*Method:*

1. Sift icing sugar into bowl.
2. Add glucose, melted copha (not hot) and egg white in a well in centre.
3. Gradually work in enough of the icing sugar to make a firm paste which will hold its shape.
4. Turn on to a board and knead until smooth.
5. Knead in the flavouring and any colouring used.
6. Keep covered until ready to use.

### 2. Plastic Icing (Cooked).

1 cup of sugar.
4 tablespoonfuls of water.
Juice of half a lemon (strained).
1¼ to 1½ lb. icing sugar.
1½ teaspoonfuls of gelatine soaked in 2 tablespoonfuls of water.
1 level dessertspoonful copha or butter.
Essence.

*Method:*

1. Moisten sugar with water and heat very gently until sugar is dissolved.
2. Bring to boil and boil quickly for three minutes.
3. Remove from stove. Add soaked gelatine, copha or butter and about ½ lb. of icing sugar.
4. When this is cool enough to handle pour into a basin containing the remainder of the icing sugar.
5. Work in the icing sugar until the mixture is firm but still pliable.
6. Add colouring and flavouring.
7. Cover until required.

N.B.—If the icing is for a white cake omit the butter.

### 3. Plastic Icing (Cooked).

4 oz. granulated sugar.
4 oz. liquid glucose.
¼ cup water.
1 teaspoonful gelatine.
3 tablespoonfuls cold water.
2½ lb. icing sugar.

*Method:*

1. Place sugar, glucose and ¼ cupful water into saucepan.
2. Heat slowly until the sugar is dissolved.
3. Boil to 238° F.
4. Remove from fire. Add gelatine, which has been soaked in the 3 tablespoonfuls cold water.
5. Sift icing sugar into a bowl.
6. Add some of the icing sugar to the syrup mixture.
7. When cool pour the syrup into the remainder of the icing sugar.
8. Gradually work in enough icing sugar to make a firm pliable paste.
9. Cover until needed.

N.B.—A sugar thermometer is necessary for this icing. The thermometer from a fruit bottling outfit may be used if a sugar thermometer is not available.

## DECORATIONS

Some decorations can be made from the plastic icing used to cover the cake. If you intend to use a coloured base, keep a little plastic icing back before colouring and this may be used for the decorations required and coloured to suit.

Plastic icing can be moulded into fruits, flowers or animals according to your design. Most of these take some time to model, so if you want to make flowers quickly try this method.

Take a small ball of the icing and roll it out until it is 1/16in. thick. Cut into circles, using the top of an old lipstick container as the cutter. As lipsticks are available in different sized containers, you can easily vary the sizes of your flowers.

With a fine knitting needle or skewer, crimp the edges in four or five places to resemble petals; put a hole in the centre and lift one side slightly to give a more interesting shape.

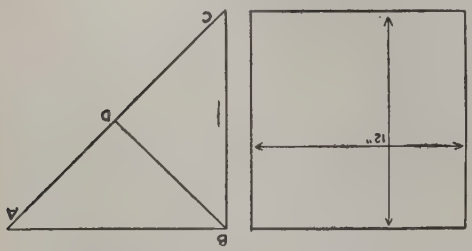



Fig 3.—Folding a square of paper to make an icing bag.

These little flowers may be turned out very quickly and provide effective decorations. Roll only a small piece of icing at a time as the icing dries quickly when it is in a thin sheet and may crack when it is being shaped.

To make leaves, use a very small scone-cutter. First cut out a circular piece of icing and then cut off a half-moon shaped piece by altering the position of the cutter. Mark in the veins with a sharp-pointed knife and curl the leaf slightly while still soft.

Allow the decorations to dry for a few hours before handling them and then attach them to the cake with a dab of royal icing.

### Royal Icing.

1 egg white.
6 to 8oz. icing sugar.
1 small teaspoonful glucose.
Few drops of lemon juice.

*Method:*

1. Beat the egg white slightly.
2. Gradually beat in icing sugar until the mixture is just stiff enough to hold its shape or stand in small heaps when the spoon is pulled away.
3. Add glucose and lemon juice.
4. Beat the icing thoroughly. The more beating this icing receives the higher gloss it develops.

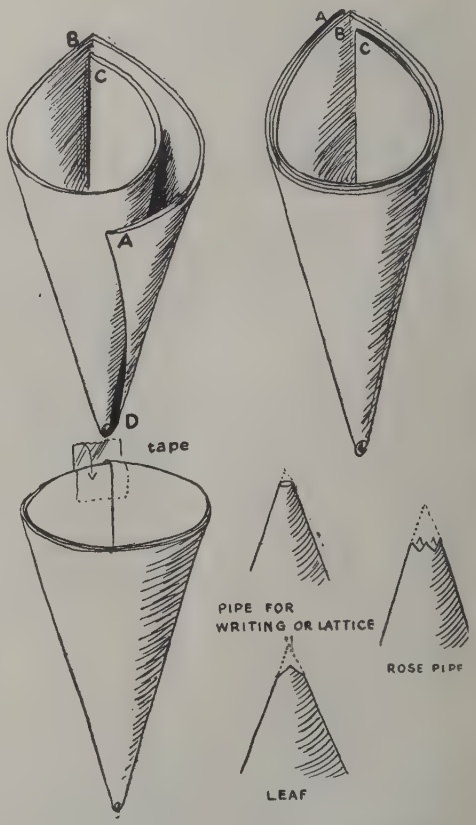



Fig. 4—Completing the paper icing bag and trimming the nozzles.

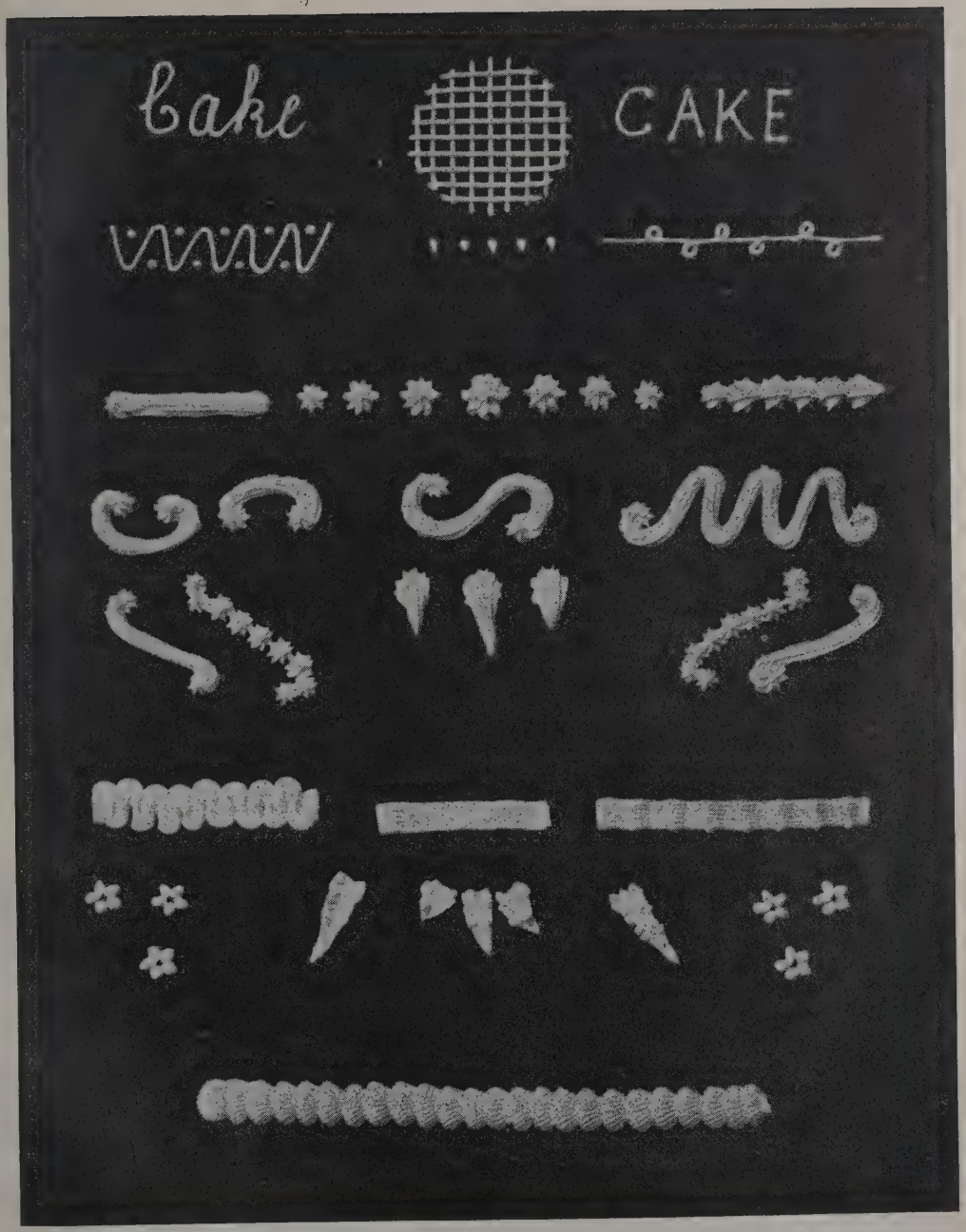



Fig. 5.—Some simple icing decorations using various nozzles. In the two top rows a No. 2 pipe is used for writing and lattice, also for dots, loops and other designs. In the next three rows an eight-star No. 8 pipe lends itself to a number of different designs.

Below a No. 34 pipe is used to give a fluted ribbon. The forget-me-nots are made with a No. 28 nozzle; the small leaves with a No. 17 and the shell-patterned bar with a No. 12.

## DECORATING WITH ROYAL ICING

To use royal icing for decorations you will need a metal icing syringe or a soft forcing-bag equipped with metal piping tubes. The metal tubes give a daintier finish than the plastic types. If no tubes are available a good substitute can be made from paper as will be described later.

To obtain uniform results use an even pressure. For roses or dots, keep the nozzle perpendicular and start with the tip of the tube close to the surface of the cake. When the required size of decoration is reached pull the nozzle away sharply at the same time releasing the pressure. For lattice work or ribbons and leaves, slope the pipe a little, then apply an even pressure and pull the nozzle towards you at the same time.

If adding a second row of decorations wait until the first one has dried out for a few minutes. When mistakes are made they can be rectified if the icing is scraped off while still wet without harming the surface of the cake.

Before commencing to pipe a design, plan it out on a piece of paper the same size as the cake. By placing the paper over the cake the main lines in the design can be pricked through on to the icing.

## GENERAL HINTS

1. Keep all icings covered with a damp cloth before using them as they harden quickly when exposed to the air.

2. Avoid using flavourings which are too highly coloured. Too much vanilla flavouring in white icing makes it look dingy. Almond essence is good flavouring to use as it is colourless and concentrated.

3. A drop of blue colouring makes white icings whiter.

4. Colourings may be mixed to give variations of tint. The mixture of pink and yellow will give an apricot toning.

5. Use highly concentrated colourings and flavourings as the addition of too much liquid makes the icing soft and difficult to handle.

6. An eye-dropper is useful for adding colourings or flavourings as the "crust" which settles on the rims of the bottles may then be avoided.

7. Icing sugar should be rolled and sifted three times before using, especially for royal icing.

8. If the liquid glucose is too hard, stand the jar in a saucepan, containing sufficient water to reach half way up the jar and heat gently. Don't add heated glucose directly to an egg white as it may cause the egg white to solidify. Allow it to cool first.

9. To remove solid glucose from a jar use a wet spoon or wet the fingers.

10. Plastic icing will keep indefinitely in an airtight tin or rolled in a piece of plastic material.

11. If the plastic icing is too hard after storage, warm it slightly on a plate over a pan of water and knead until soft. A little water may be added if the icing appears too dry.

12. Decorations made from plastic icing or royal icing keep well and can be made some time in advance.

13. After making plastic icing, allow it to stand for two or three hours to mature. This makes it easier to handle.

14. Use a fine artist's brush to paint the colours upon decorations such as fruits or leaves when deeper shades are required.

15. Use liquid glucose in preference to powdered glucose in icings. This is usually obtainable from a grocer or chemist.

## TO MAKE PAPER ICING BAGS

Take a piece of paper 12in. square (lunch wraps are quite useful for this work) and fold the paper diagonally to form a triangle as shown in the diagram. Roll point C over to meet B so that the line CD lies on BD.

Hold in position and wrap AD round to hold the cone in shape.

Fold the top peak over to keep the top firm. The last fold may be held in position by a strip of cellulose tape.

Cut a small piece for the point to make a hole about 1/16in. in diameter. This will be suitable for writing, lattice work or dots.

To make a nozzle for piping roses cut a few small serrations at the point of the cone. The larger the hole, the larger the rose and more serrations will be needed.

To make leaves cut the peak to form sharp points.

# "CLAYPANS" IN THE NORTH-WEST SPINIFEX AREAS

## Their Origin and Reclamation

By H. SUIJDENDORP, B.Sc. (Agric.), Agricultural Adviser.

**"CLAYPANS" are common in the spinifex areas of our North-West, particularly on stations near the coast. Many are increasing in area owing to wind erosion but some reclamation is possible by suitable furrowing and surface roughening. In this article the term "claypans" is used in referring to areas where the topsoil has been blown away and the bare subsoil is left. In many cases this subsoil contains a considerable percentage of clay.**

Overgrazing or droughts, or possibly a combination of these factors originally caused denudation of useful grassy plains in the North-West. Wherever invading masses of cold air from the ocean meet the masses of hot air over the land, small whirlwinds (so called "willy-willies") are formed which travel along the cold front. These willy-willies blow away the topsoil on the denuded areas and the first small claypans make their appearance. Successive willy-willies cause the claypans to increase in size so that they often join up with one another and this process persists until eventually claypans up to 25 square miles in area are encountered. Once a claypan has spread over a few hundred acres it is big enough to heat the air mass above it and the heated air will produce willy-willies where it meets the surrounding cooler air so that the erosion continues with ever-increasing rapidity.

Most claypans are impervious to water, and any rain that falls on them must either run off or evaporate from the surface. In the first case, where the land is sloping, extensive gully erosion will result. In the second case, salts deposited by the rain are left behind when the water evaporates and these salts accumulate

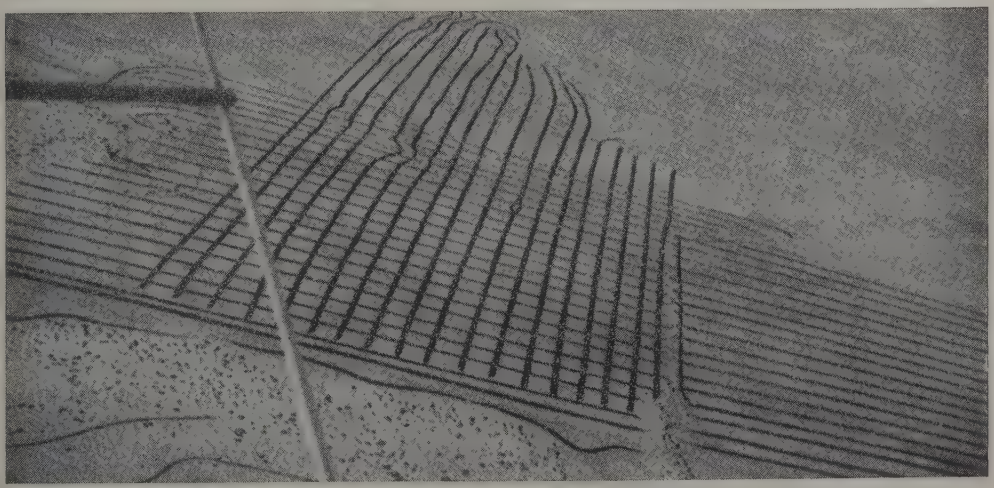


Fig. 1.—An aerial photograph showing checkerboard furrows on claypan country at Mundabullangana Station.

Fig. 2.—Contour furrows on sloping country.

year after year. Some soil samples from the claypans contained as much as 3 per cent. of total salts, two-thirds of which was sodium chloride (common salt). When it is realised that 0.25 per cent. of salt in the surface layers of the soil is toxic to the growth of many plants, the disastrous nature of this tendency is readily apparent.

## RECLAMATION

It has often been asked whether reclamation is either necessary or economical where such large areas of land with a low carrying capacity are involved.

It must be remembered that the claypans often appear in the best tracts of country, i.e., the grassy plains, as spinifex* is more resistant to overgrazing. Also, holding paddocks near shearing sheds often suffer from the development of claypans as overgrazing is more likely to occur there. As available forage diminishes in quantity, overgrazing increases and claypan formation is speeded up. Soon the property becomes unmanageable with bare holding paddocks, and eventually the entire property will be affected. There is evidence that some claypans are being reclaimed voluntarily by buffel grass (Cenchrus ciliaris). It emerges from the spinifex on the banks of the claypans and builds up new topsoil by catching and stabilising windblown soil among the tussocks. This process is very slow however and some assistance by mechanical means is necessary.

## SURFACE ROUGHENING IMPORTANT

In principle all the reclamation methods aim to achieve one purpose. The object is to slow down wind velocity at the surface and so induce windborne soil and seed to settle. Consequently, the rougher and more uneven the surface is left the better it will achieve this purpose.

Ploughing up the entire area involved would seem to be the logical answer but, due to the large acreages carrying claypans, such a remedy would be too time-consuming and expensive. A compromise method is to treat the surface by breaking it up in a checkerboard pattern leaving a considerable portion of the surface untreated. Where the surface slopes, a system of contour furrows would be more suitable.

## IMPLEMENTS TO USE

In 1952 and 1953 reclamation was attempted at Mundabullangana Station using both Departmental and Station

*The various species of *Triodia*, which are generally called "spinifex," are actually grasses, speaking botanically, but in general parlance are generally considered distinct because of their growth habit and spiny nature.

plant. In 1953, Departmental plant was also used to treat some 200 acres at Muccan Station.

Systems of checkerboard and contour furrows were put in using different implements. Each implement has its merits under different conditions.

The implements used are listed hereunder together with remarks as to their suitability under different conditions.

1. **A three-furrow mouldboard plough** was used in double runs (in opposite directions). This throws up a fair-sized bank with a furrow at either side. This practice is useful on salty soils as the salts leach out and eventually grasses become established.

2. **A single-furrow mouldboard plough** on single runs only. This seems to be the most useful general purpose implement but is not so suitable for coping with salty conditions.

3. **A tyne cultivator.**—This implement is very useful in the initial stages of claypan formation as it covers a much larger area than other implements in the same operating time. It is less satisfactory where soil is flooded during wet weather as the furrows wash out easily.

4. **A single-tyned ripper.** This implement is very useful on hard soils and leaves the soil in a desirable, rough, cloddy condition. Furrows fill up easily however and flatten out wherever water runs.

## CONCLUSIONS

Work done with the three-furrow and single-furrow mouldboard ploughs will usually stand up to several wet seasons without washing out particularly, but spectacular results should not be expected in one season.

On old-established claypans, four stages of reclamation can be recognised:—

(a) Leaching of salts from banks. Little vegetation.

(b) Establishment of annuals, mainly Button grass *(Dactyloctenium radulans)*.

(c) Establishment of perennials, mainly Buffel grass *(Cenchrus ciliaris)*.

(d) Spreading of perennials from banks and furrows, build up topsoil in the process.

Each of these stages may take one or more years depending on the seasons. On the other hand, on newly formed claypans, some stages do not show up or are combined.

Work already undertaken indicates that the reclamation of claypans is well within the limits of practicability.

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# HERE'S THE ANSWER

## FOOT ROT IN CATTLE

*Foot rot seems to have broken out among my dairy herd and several cows are very lame in the front feet. The first joint of the feet appears to be inflamed and painful.*

*I have been advised to use sulphamezathine and would like to have some information concerning suitable dosages and method of administration.*

Sodium Sulphamezathine, 33.1/3% solution, is highly effective for the treatment of foot rot.

The dosage for dairy cows is 100 c.c. given by subcutaneous injection and repeated when necessary after an interval of three days. In the majority of cases complete recovery occurs within 72 hours of the first injection, and it is only in chronic cases that repeated treatment may be necessary. Leaflet No. 1015, "Foot Rot (Foul Foot) of Dairy Cattle", is available free of charge from the Department of Agriculture and gives full details of this disease and its treatment.

## COAST DISEASE

*Despite the fact that the drinking water was treated with cobalt I recently lost a second cow from "coast disease". A neighbour who has had a lot of experience with this complaint told us that at the first sign of coastiness he moves his cattle to an adjacent property where the food is similar but the cattle have to drink bore water, which seems to cure them in a short time. Can you give any explanation for this?*

Since "coast disease" results from a dual deficiency of copper and cobalt it appears that the bore water consumed by cattle must have contained these minerals. Confirmation could, of course, be obtained by submitting a sample of the water for analysis.

It is the practice of many stockowners to transfer their cattle and sheep from the coastal areas to sound inland country at regular intervals. While running on the sound country the animals obtain supplies of copper and cobalt which are stored in the liver and the animals may then be returned to the coast country for a period of a few months.

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# SUNRISE AND SUNSET TIMES FOR SEPT.-OCT., 1954

**(Supplied by the Government Astronomer)**

**Times of sunrise and sunset for every fifth day, are given for a number of towns throughout the State. Times for a town not on the list may be estimated if its position in relation to one or more of the listed towns is known. The times given for sunrise are those of the first appearance of the top edge of the sun over a true horizon; those for sunset give the time of the sun's disappearance below a true horizon. Situation in a valley would make the sun appear to rise later, and on a hill it would appear earlier.**

## SUNRISE

| Month. | Day of Month | Broome. | Port Hedland. | Onslow. | Carnarvon. | Yalgoo. | Geraldton. | Moora. | Kalgoorlie. | Southern Cross. | Merredin. | Perth. | Tammin. | Northam. | Narrogin. | Collie. | Bunbury. | Katanning. | Bridgetown. | Hopetoun. | Esperance. | Cape Leeuwin. | Albany. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sept.... | 1 | 5·59 | 6·15 | 6·30 | 6·37 | 6·28 | 6·37 | 6·33 | 6·11 | 6·20 | 6·24 | 6·35 | 6·28 | 6·31 | 6·29 | 6·34 | 6·36 | 6·29 | 6·34 | 6·19 | 6·12 | 6·39 | 6·28 |
| ,, .... | 5 | 5·54 | 6·12 | 6·27 | 6·34 | 6·24 | 6·33 | 6·29 | 6·7 | 6·16 | 6·20 | 6·30 | 6·23 | 6·26 | 6·25 | 6·30 | 6·32 | 6·24 | 6·29 | 6·14 | 6·7 | 6·34 | 6·23 |
| ,, .... | 10 | 5·51 | 6·7 | 6·22 | 6·28 | 6·17 | 6·27 | 6·22 | 6·0 | 6·9 | 6·13 | 6·23 | 6·16 | 6·19 | 6·18 | 6·23 | 6·25 | 6·17 | 6·22 | 7·7 | 6·0 | 6·27 | 6·16 |
| ,, .... | 15 | 5·48 | 6·3 | 6·18 | 6·23 | 6·12 | 6·22 | 6·16 | 5·54 | 6·3 | 6·7 | 6·17 | 6·10 | 6·13 | 6·12 | 6·17 | 6·19 | 6·11 | 6·16 | 7·1 | 5·54 | 6·21 | 6·9 |
| ,, .... | 20 | 6·43 | 5·58 | 6·12 | 6·17 | 6·6 | 6·15 | 6·9 | 5·47 | 5·56 | 6·0 | 6·10 | 6·3 | 6·6 | 6·4 | 6·9 | 6·11 | 6·3 | 6·8 | 5·53 | 5·46 | 6·13 | 6·1 |
| ,, .... | 25 | 5·38 | 5·53 | 6·7 | 6·12 | 5·59 | 6·8 | 6·2 | 5·40 | 5·49 | 5·53 | 6·3 | 5·56 | 5·59 | 5·57 | 6·2 | 6·4 | 5·56 | 6·1 | 5·46 | 5·39 | 6·6 | 5·54 |
| ,, .... | 30 | 5·35 | 5·50 | 6·3 | 6·8 | 5·55 | 6·3 | 5·57 | 5·35 | 5·44 | 5·48 | 5·58 | 5·51 | 5·54 | 5·51 | 5·56 | 5·58 | 5·50 | 5·55 | 5·40 | 5·33 | 6·0 | 5·48 |
| Oct. .... | 1 | 5·34 | 5·49 | 6·2 | 6·7 | 5·54 | 6·2 | 5·56 | 5·34 | 5·43 | 5·47 | 5·57 | 5·50 | 5·53 | 5·50 | 5·55 | 5·57 | 5·49 | 5·54 | 5·39 | 5·32 | 5·59 | 5·47 |
| ,, .... | 5 | 5·31 | 5·45 | 5·58 | 6·2 | 5·49 | 5·57 | 5·51 | 5·29 | 5·38 | 5·42 | 5·51 | 5·44 | 5·47 | 5·45 | 5·50 | 5·52 | 5·43 | 5·48 | 5·33 | 5·26 | 5·53 | 5·41 |
| ,, .... | 10 | 5·27 | 5·41 | 5·54 | 5·58 | 5·44 | 5·53 | 5·45 | 5·23 | 5·32 | 5·36 | 5·45 | 5·38 | 5·41 | 5·39 | 5·44 | 5·46 | 5·37 | 5·42 | 5·27 | 5·20 | 5·47 | 5·34 |
| ,, .... | 15 | 5·22 | 5·36 | 5·49 | 5·52 | 5·37 | 5·46 | 5·38 | 5·16 | 5·25 | 5·29 | 5·38 | 5·31 | 5·34 | 5·31 | 5·36 | 5·38 | 5·29 | 5·34 | 5·19 | 5·12 | 5·39 | 5·26 |
| ,, .... | 20 | 5·19 | 5·32 | 5·44 | 5·47 | 5·32 | 5·40 | 5·32 | 5·10 | 5·19 | 5·23 | 5·32 | 5·25 | 5·28 | 5·25 | 5·30 | 5·32 | 5·23 | 5·28 | 5·13 | 5·6 | 5·33 | 5·20 |
| ,, .... | 25 | 5·16 | 5·29 | 5·41 | 5·43 | 5·28 | 5·36 | 5·28 | 5·6 | 5·15 | 5·19 | 5·27 | 5·20 | 5·23 | 5·20 | 5·25 | 5·27 | 5·17 | 5·22 | 5·7 | 5·0 | 5·27 | 5·14 |
| ,, .... | 31 | 5·12 | 5·25 | 5·37 | 5·38 | 5·22 | 5·30 | 5·21 | 4·59 | 5·8 | 5·12 | 5·21 | 5·14 | 5·17 | 5·13 | 5·18 | 5·20 | 5·11 | 5·16 | 5·1 | 4·54 | 5·21 | 5·7 |

## SUNSET

| Month. | Day of Month | Broome. | Port Hedland. | Onslow. | Carnarvon. | Yalgoo. | Geraldton. | Moora. | Kalgoorlie. | Southern Cross. | Merredin. | Perth. | Tammin. | Northam. | Narrogin. | Collie. | Bunbury. | Katanning. | Bridgetown. | Hopetoun. | Esperance. | Cape Leeuwin. | Albany. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sept.... | 1 | 5·43 | 5·57 | 6·10 | 6·13 | 5·58 | 6·7 | 5·59 | 5·37 | 5·46 | 5·50 | 5·59 | 5·52 | 5·55 | 5·53 | 5·38 | 6·0 | 5·51 | 5·56 | 5·41 | 5·34 | 6·1 | 5·48 |
| ,, .... | 5 | 5·45 | 5·59 | 6·12 | 6·15 | 6·1 | 6·10 | 6·2 | 5·40 | 5·49 | 5·53 | 6·3 | 5·56 | 5·59 | 5·56 | 6·1 | 6·3 | 5·55 | 6·0 | 5·45 | 5·38 | 6·5 | 5·52 |
| ,, .... | 10 | 5·45 | 5·59 | 6·12 | 6·16 | 6·3 | 6·11 | 6·5 | 5·43 | 5·52 | 5·56 | 6·5 | 5·58 | 6·1 | 5·59 | 6·4 | 6·6 | 5·57 | 6·2 | 5·47 | 5·40 | 6·7 | 5·55 |
| ,, .... | 15 | 5·46 | 6·1 | 6·14 | 6·19 | 6·6 | 6·14 | 6·8 | 5·46 | 5·55 | 5·59 | 6·9 | 6·2 | 6·5 | 6·2 | 6·7 | 6·9 | 6·1 | 6·6 | 5·51 | 5·44 | 6·11 | 5·59 |
| ,, .... | 20 | 5·46 | 6·1 | 6·15 | 6·20 | 6·8 | 6·17 | 6·11 | 5·49 | 5·58 | 6·2 | 6·12 | 6·5 | 6·8 | 6·5 | 6·10 | 6·12 | 6·4 | 6·9 | 5·54 | 5·47 | 6·14 | 6·2 |
| ,, .... | 25 | 5·48 | 6·3 | 6·17 | 6·22 | 6·11 | 6·20 | 6·14 | 5·52 | 6·1 | 6·5 | 6·15 | 6·8 | 6·11 | 6·9 | 6·14 | 6·16 | 6·8 | 6·13 | 5·58 | 5·51 | 6·18 | 6·6 |
| ,, .... | 30 | 5·49 | 6·4 | 6·19 | 6·24 | 6·13 | 6·23 | 6·17 | 5·55 | 6·4 | 6·8 | 6·18 | 6·11 | 6·14 | 6·13 | 6·18 | 6·20 | 6·12 | 6·17 | 6·2 | 5·55 | 6·22 | 6·10 |
| Oct. .... | 1 | 5·49 | 6·4 | 6·19 | 6·24 | 6·13 | 6·23 | 6·17 | 5·55 | 6·4 | 6·8 | 6·18 | 6·11 | 6·14 | 6·13 | 6·18 | 6·20 | 6·12 | 6·17 | 6·2 | 5·55 | 6·22 | 6·10 |
| ,, .... | 5 | 5·49 | 6·5 | 6·20 | 6·26 | 6·15 | 6·25 | 6·19 | 5·57 | 6·6 | 6·10 | 6·21 | 6·14 | 6·17 | 6·15 | 6·20 | 6·22 | 6·15 | 6·20 | 6·5 | 5·58 | 6·25 | 6·13 |
| ,, .... | 10 | 5·50 | 6·6 | 6·21 | 6·28 | 6·18 | 6·27 | 6·23 | 6·1 | 6·10 | 6·14 | 6·24 | 6·17 | 6·20 | 6·19 | 6·24 | 6·26 | 6·18 | 6·23 | 6·8 | 6·1 | 6·28 | 6·17 |
| ,, .... | 15 | 5·52 | 6·8 | 6·24 | 6·31 | 6·21 | 6·31 | 6·27 | 6·5 | 6·14 | 6·18 | 6·29 | 6·22 | 6·25 | 6·23 | 6·28 | 6·30 | 6·23 | 6·28 | 6·13 | 6·6 | 6·33 | 6·22 |
| ,, .... | 20 | 5·35 | 6·10 | 6·26 | 6·33 | 6·24 | 6·34 | 6·30 | 6·8 | 6·17 | 6·21 | 6·32 | 6·25 | 6·28 | 6·27 | 6·32 | 6·34 | 6·27 | 6·32 | 6·17 | 6·10 | 6·37 | 6·26 |
| ,, .... | 25 | 5·55 | 6·12 | 6·28 | 6·36 | 6·28 | 6·38 | 6·34 | 6·12 | 6·21 | 6·25 | 6·36 | 6·29 | 6·32 | 6·32 | 6·37 | 6·39 | 6·32 | 6·37 | 6·22 | 6·15 | 6·42 | 6·31 |
| ,, .... | 31 | 5·57 | 6·14 | 6·31 | 6·39 | 6·31 | 6·42 | 6·38 | 6·16 | 6·25 | 6·29 | 6·41 | 6·34 | 6·37 | 6·36 | 6·41 | 6·43 | 6·37 | 6·42 | 6·27 | 6·20 | 6·47 | 6·36 |